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ABSTRACT

Perspectives on contemporary creationism are offered and the effects of that movement on public education are examined in this collection of articles. Six papers address concerns related to: (1) the detrimental impact of creationism on the teaching of science and on the understanding of the natural sciences; (2) efforts in confronting creation pseudoscience and creationists' attempts to controlling the schools; (3) evolution's coverage in textbooks; (4) exclusion of the subject of evolution in biology textbooks; (5) treatment of evolution in seven new life-science textbooks; and (6) political movement and the aspirations of the creationists. (ML)

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CRUSADE OF THE CREDULOUS

A Collection of Articles About Contemporary Creationism and the Effects of that Movement on Public Education

WILLIAM J. BENNETTA

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The articles "Crusade of the Credulous" and "Confronting the Armies of the Night" first appeared in the January-March 1985 issue of *Pacific Discovery*, Volume 38, Number 1.

The articles "Looking Backward" and "Faking It" first appeared in the October-December 1985 issue of *Pacific Discovery*, Volume 38, Number 4.

All four articles are reprinted substantially as they appeared in the issues cited above. The articles as reprinted do not mention or reflect subsequent events or changes in mentioned publications.

The articles "Experiences in Publishing" and "Bold Aspirations" are appearing for the first time in this publication.

WILLIAM J. BENNETTA is a scientific consultant, a professional editor, and a research associate of the California Academy of Sciences. His interests include evolutionary biology, the interactions between biology and public policy, and the influence of the press on the public's understanding and misunderstanding of science.

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Foreword

RECENTLY MY MAIL brought a letter from someone who held me and other scientists responsible for "getting evolution taught as fact in science textbooks for boys and girls." The writer continued, "it is impossible to actually return to the past to see if things happened the way the experiment is trying to prove." Therefore, he concluded, "evolution is no fact and to say so is not good science." He went on to assert that evolution is merely a justification for some people's decision not to believe in God, and that supporters of evolution were atheists and agnostics who want to make such thinking the "church" of the public schools.

My correspondent is correct about our efforts to have evolution taught as fact in science textbooks; and he is also correct that it is impossible to return to the past. He is wrong, however, that no scientific inferences can be made about the past, and he is wrong about the fact of evolution. Further, every major religion recognizes that there need be no spiritual conflict between the concepts of God and evolution. Why, then, are so many people confused about these things?

It is becoming painfully evident to scientists that science education in the United States is very largely the memorization of a lot of facts. These facts may or may not be connected by scientific ideas and scientific methods. I am continually surprised by undergraduate students who do not realize that scientists do not write scientific papers to try to prove things. Today's philosophers of science recognize that proof is a very difficult concept; they prefer to confine scientific activity to supporting or rejecting hypotheses that can be tested by empirical means according to scientific criteria. Proof is usually restricted to mathematics (despite the informal jargon of many scientists),

and even there one is not always on secure ground. How to explain this to a child? It's very difficult—so difficult, in fact, that it seldom seems to get done at all.

As a result, our society is full of misconceptions about what the business of science really is. Our president has said that evolution is "only a theory," which is about half right. It is a theory, but it is also fact. I'm not sure what "only" a theory is supposed to mean. There is a substantial difference between the meanings of the term *theory* in scientific and popular parlances. Regardless of its use in the *National Enquirer* and elsewhere, a theory is not merely some untested notion that a wild-eyed person in a white lab coat came up with in the middle of a long night after too much coffee. A scientific theory is a body of facts and hypotheses subject to refutation, but currently understood as a robust explanation of all available evidence. The so-called theory that the six-mile-long trenches cut in the Peruvian countryside were landing strips for UFOs does not qualify as a scientific theory—not because it is necessarily wrong, but because we have no way to test the proposition that UFOs were there then or were communicating with the native inhabitants. The test that UFOs exist at all has not turned up particularly robust results so far. The so-called theory explains nothing that cannot be explained by other less extraordinary hypotheses.

Similarly, the explanation "because God made it that way" is a valid proposition, but it leaves little for science to investigate. Science is concerned with how the world works, not with the spiritual forces that may govern it but are insensible to our methods. For this reason, evolution—which studies the mechanics of organic change—is science, whereas speculations about the origin of life can very quickly exceed the limits of what can be asserted on scientific grounds.

What is the relationship between facts and theories? Gravity is a theory. It is also a fact. Electricity is a theory. It is also a fact. Evolution is a theory. It is also a fact. The relationship is hierarchical. Many facts are adduced to support or refute theories. Apples fall on Newton's head, Galileo drops large objects off the Tower of Pisa, astronauts can jump farther on the Moon. The theory of gravity explains these observations coherently, and this theory has changed substantially since the eras of Galileo and Newton. Even now, we have much to learn about it, as became evident when scientists recently found that the "gravitational constant" that explained the rate of fall of small bodies was not a constant, but a fluid relationship. Do we then throw out the theory of gravity? No: we modify it to accommodate these new observations.

Creationism, on the other hand, is a religious belief. It is not, as its adherents often proclaim, a scientific theory; and the facts that are brought up to support creationism as science are explained equally well by modern biology. Religious belief differs from scientific belief in that the business of science is to discover new information that will reinforce or challenge its own understanding. Generally, religious belief is a matter of faith that does not seek to test or refute itself. Also, its criteria for rejecting its own tenets differ from those of science: it is hard to imagine any empirical facts of science that would lead an evangelical Christian, for example, to reject his faith in Jesus. And rightly so. There may be a desirability, but there is certainly no obligation, for the concerns of the material and spiritual worlds to correspond with each other.

How, then, do we deal with conflicts about the understanding of the material and physical worlds when they arise? My own feeling is that it is a mistake to regard the spiritual, historical, and cultural docu-

ments of the major religions as treatises on scientific fact and theory. Biblical scholars agree that this was not the intention of the original authors, and the myriad translations and transmutations of the original texts have made literal interpretation (if such an oxymoron can be admitted) very problematic. Jonah was not swallowed by a fish; the whale is a mammal. And, as one analyst has pointed out, the Earth cannot simultaneously be 4.5 billion years old in a science class and 10,000 years old in a social studies class. Scientists may indeed be terribly mistaken about everything they think that they know. And the possibility remains that scientific evidence that conflicts with certain Biblical interpretations was rigged by evil supernatural forces to deceive us and lead us away from the truth. But what is one to believe of a Creator who allows this to happen? Science must take the world as it is and formulate hypotheses about it with a grain of salt.

Anti-evolutionists have recently tried

to capture another term in the sociopolitical arena. (Their use of the first word they've captured, *creationist*, implies that people who believe in creation cannot believe in evolution. This assertion, despite the urgings of the anti-evolutionists, is incorrect.) They object to the teaching of evolution as fact because it infringes on the rights of the "Christian child." And yet only a vocal minority of Protestant fundamentalists who insist on their own interpretation of the Bible object to the teaching of evolution in public schools. To imply that they speak for all Christians is inaccurate, unfair, and misleading.

There is a second problem here. It comes from the insistence by these same fundamentalists that if evolution is taught it be taught only as theory. This would be fine with scientists, as long as all science were taught as theory. But roping off evolution as theory is not accurate or fair and only further misleads children about the nature of science.

An important point unifies both these

concerns. Education does not compel people to believe, only to understand. Those who do not wish to be exposed to ideas contrary to their own are not resisting indoctrination: they are resisting education itself.

Bill Bennetta's essays on these topics, which first appeared in the magazine *Pacific Discovery*, have been of considerable importance, for they galvanized much of the scientific and educational community in California. As part of Bill's campaign to make the public aware of a decade of deterioration in science texts, to make state officials understand just how far this has gone, and to make scientists react by getting involved in the process, they have been of inestimable value to the future of science education in California and across the country.

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CRUSADE OF THE CREDULOUS

If you care about the quality of education in the United States, if you believe that the power of government should not be used to enforce religious beliefs, if you find elegant accuracy in modern understandings of the natural world—you may be in for a rude shock.

Right now, a vigorous political movement is striving diligently to cripple the teaching of science in public schools and to damage the natural sciences over all. The name of this regressive crusade? Creationism.

ABOUT 2,500 YEARS AGO, the Israelites fashioned the opening chapters of the Bible by canonizing a number of stories about the origin of the universe, the early history of Earth, the origin of Earth's organisms, and the early history of man. Some of the stories had originated among the Israelites or their ancestors. Some others, including a tale about a great flood, were recastings of myths told by other peoples of the Near East; references to multiple gods had been eliminated, and the creation and control of the universe had been vested in one god only.^{1,2}

About 1,700 years ago, the Roman potentate Constantine formed a political alliance with Christianity. From this event sprang the political ascendancy of Christianity in the West and the political installation of the biblical creation stories as the definitive account of the origin of all that is.³

About 200 years ago, an expanding body of information about Earth and its

organisms began to make those stories untenable as explications of nature. By the early 1800s scientists knew that the size and structure of sedimentary deposits bespoke not a year-long flood but a process that had operated for prodigious periods of time. They knew that the world had far more species of animals than could have survived the biblical flood on a boat less than 500 feet long. And they knew that fossils (which traditionally had been interpreted as the remains of creatures that had missed the boat) were distributed in ways that couldn't be explained by a flood or even by a great series of floods. By the middle of the century, despite some ingenious and antic attempts at making the evidence match the Bible, learned men abandoned biblical catastrophism in favor of uniformitarianism—the principle that Earth has been shaped not by supernatural manipulations but by natural forces that still are at work. Soon afterward, Darwin and Wallace promulgated a uniformitarian foundation for biology: evolution by natural selection.

About 100 years ago, evolution became the unifying principle of biology and the essential explanation for the origin of species past and present. Belief in the literal truth of the Bible lost favor among the educated, and the scope and doctrines of religion were redefined in ways that accommodated the realities of science. In effect, religion and science were separated, and each was assigned to its own realm.

About 80 years ago, biblical literalism was revived in the United States through a political movement that has come to be called creationism. Its adherents believed not only that the Israelites' creation stories were true but also that the discussion of uniformitarian science in public schools was undermining Christianity and engendering various social ills. The creationists secured the enactment of proscriptive

statutes in several states of the South, and one of these gave rise in 1925 to a national circus. A teacher named John T. Scopes was charged with violating a Tennessee law that forbade the teaching of evolutionary biology, and his trial became a spectacle in which creationism and the creationists were made ridiculous.

About 3 years ago, a federal judge in Little Rock nullified an Arkansas law that was a distant descendant—highly modified but quite recognizable—of the one that Scopes had broken. Rather than proscribing evolutionary biology, the Arkansas law sought to contravene it and vitiate it: A teacher who described evolution would also have to present a collection of thinly disguised Bible stories as a plausible alternative for explaining Earth and life. In doing so, the teacher would have to offer "evidences" favoring assertions that the universe, energy, and life had been created suddenly from nothing; that evolution by natural selection couldn't have produced all the extant species of organisms from one progenitor; that geological phenomena can be explained by catastrophism "including the occurrence of a worldwide flood"; and that Earth and its organisms have only recently come into being.⁴ Textbooks and library materials would have to do the same.

The Arkansas case—about which you'll read more below—was a spectacular chapter in an eccentric and dismaying story: the recent resurgence of creationism in the United States, and the creationists' use of a refined and effective strategy for enlisting the power of the state in the propagation of superstition.

The story is still unfolding, and its outcome won't be known before many years have passed. The creationists lost their case in Arkansas, and they probably will lose a similar case in Louisiana,⁵ but skirmishes in federal courts aren't of primary importance here. The principal engage-

ments are fought in schools, in school-district headquarters, in state agencies that select curricula and textbooks, and in the offices of textbook-publishers. And in these places, the creationists have been winning numerous and unambiguous victories since the early 1960s. They have stifled the teaching of evolutionary biology in local schools; they have induced various school districts to inject creation myths and creationistic literature into science classes; and they have forced textbook-publishers to attenuate, dilute, or expunge discussions of the origin of life, the principle of evolution, the origin of man, and related subjects.

In these ways the creationists are exerting a powerful and corrosive influence on the national intellect. They are corrupting not just science education but the intellectual foundation on which all enlightened education stands. They are undermining not just the rational comprehension of nature but rationality itself.

CREATIONISM IS a political movement, and understanding it requires continual attention to its political structure, its political operations, and its political objectives. The creationists' principal and ultimate goal is to abolish natural science as it now exists, while replacing it with a system of pseudoscience devoted to affirming biblical narratives. In working toward that goal, they attempt to corrupt the public's understanding of science itself and of science's findings. Their most conspicuous efforts in that context are aimed at distorting and undermining the teaching of science in the public schools.

The creationists have neither an intellectual base nor a theoretical consistency—and because their movement is political, they don't need either. To the extent that they are consistent, the consistency is programmatic and ideological. Their program combines anti-intellectualism with theocracy. Their ideology combines willful ignorance with an intuitive certainty that the teaching of evolutionary biology has promoted any number of pernicious social phenomena, from "the progressive worsening of crime, delinquency, im-

morality and even war"⁶ to the "streaking" fad of the 1970s.

Though contemporary creationism has found its form and force during the past twenty-five years or so, it is in every way an extension of the creationism of the 1920s. It can be traced directly to the original fundamentalists, who sought deliberately to upset the truce that had been struck in the late 1800s between science and religion. Nelkin⁷ provides this sketch of their early history:

Fundamentalism was an American movement that developed around the turn of the century, and expanded with a publication in 1909 of a series of pamphlets entitled Fundamentals. The pamphlets attacked "modernism" and, in particular, evolution theory; the idea that evolution involved discrete accidental changes determined by the circumstances of the moment shattered fundamentalist faith in planned and purposeful change. They attacked the theory with zeal and enterprise, and worried about its implications for Christian behavior.

By the 1920s the issue of evolution divided Protestant churches; fundamentalists denied the validity of evolution and modernists sought to reconcile their faith with science. Control over educational institutions was a major arena for their battles. The major fundamentalist reaction against evolution took place in "backwoods" areas. . . . Indeed, among Northerners who had reconciled religion and evolution, the old assumption about the incompatibility of science and religion seemed almost absurd by the time the Scopes trial brought the issue to national prominence. In fact, the trial was not intended to raise this issue at all. Rather, it was provoked by the American Civil Liberties Union to show that Tennessee's antievolution legislation violated the First Amendment. The constitutional question, however, was buried as William Jennings Bryan [leading the prosecution] and Clarence Darrow [leading the defense] clashed over questions of religion and morality. . . .

Darrow turned the trial into a display of the fundamentalists' ignorance, the national press described it at length, and Tennessee gained a durable reputation for benightedness.⁸ But the trial was neither the culmination of the creationist effort nor its knell. Scopes was convicted, Tennessee's law forbidding the teaching of

evolution remained in force, and the creationists continued to promote such laws in other states; they succeeded in Mississippi in 1926 and in Arkansas in 1928. Their legislative campaign petered out at the end of the decade, but chiefly because they changed their tactics. Instead of lobbying in state capitals, they directed their energies toward teachers, textbooks, and libraries in local communities. Numbers⁹ summarizes the result thus:

Their new approach attracted less attention but paid off handsomely, as school boards, textbook publishers, and teachers in both urban and rural areas, North and South, bowed to their pressure. Darwinism virtually disappeared from high school texts, and as late as 1941 one-third of American teachers feared being identified as evolutionists.

Grabiner and Miller¹⁰ have compared high-school books published before the Scopes trial with books published afterward, and they have offered this analysis: *Believing that they had won in the forum of public opinion, the evolutionists of the late 1920's in fact lost on their original battleground—the teaching of high school biology. . . . [The] teaching of evolution in the high schools—as judged by the content of the average high school biology textbooks declined after the Scopes trial. Not until 1960, when the new Biological Sciences Curriculum Study texts came out was the treatment of evolution in the most widely used high school texts substantially improved over that found before the Scopes trial.*

The last of the state laws that forbade the teaching of evolutionary biology were abolished in the late 1960s: Tennessee's in 1967, Arkansas's and Mississippi's in 1968. To be sure, many states retained statutes and policies that weakened such teaching by prescribing that evolution could be presented only as some sort of speculation. But there was no state in which—in principle—a teacher could be sacked for merely mentioning Darwin's name.

One might imagine, then, that the 1960s were years of retreat for the creationists, but the opposite is true. In that decade, the creationists expanded their ranks, developed a new political strategy, and began using that strategy effectively.

Nelkin⁷ attributes this revitalization to

three principal factors. One was a resentment of the authority represented by science itself and by the federal and state agencies that dealt with curricula and textbooks. Another was a belief that scientific rationality was a threat to egalitarian values and political pluralism. The third was a broad disenchantment with the social import of science, of technology, and of technological products; it was reflected not only in the renewal of creationism but also in the ascendance of mysticism, astrology, and other irrational diversions.

These factors weren't new; they could be seen clearly in the writings and speeches of fundamentalists of the 1920s. But they now asserted themselves with new strength, and they gave rise to a new and relatively sophisticated brand of creationism—creationism that tried to look like science.

THE GRAND STRATEGY of contemporary creationism has two parts: to make biblical stories and uniformitarian science appear to be alternative, equally rational, equally meritorious systems for explaining nature; and then to demand that the two be made equally prominent in public-school curricula. All that the creationists want, they say, is a fair shake; an opportunity to have their interpretations presented beside the interpretations that they reject; in other words, equal time.

Don't misunderstand. Creationists haven't abandoned simple intimidation and rabble-raising in their transactions with agencies of government. But when they want to look respectable, they turn to a strategic gimmick that they call *creation science* or *scientific creationism*. Both terms are absurd and specious, and both must be rejected. A more accurate name is *creation pseudoscience*.

Creation pseudoscience is a melange of sophisms, part-truths, and falsehoods, intended to suggest that nature provides evidence that supports the biblical creation stories. It has been devised by men who take polemical convenience as their only standard, and this fact is the key to appreciating it. It is not an intellectual discipline but a polemical contraption.

The authors of creation pseudoscience labor in various Bible schools and in several organizations that are devoted principally or wholly to the pseudoscientific effort. These organizations include the Creation Research Society (Ann Arbor, Michigan), the Bible-Science Association (Minneapolis, Minnesota), the Creation-Science Research Center (San Diego, California), and the Institute for Creation Research (El Cajon, California).

The first axiom of creation pseudoscience, implicit or explicit in all its exercises, is that there are exactly two possible ways to explain nature. One way comprises the interpretations that have emerged from physics, chemistry, geology, biology, and other disciplines. The second comprises the god-and-flood tales of the Bible. There are no others.

This dichotomy, ridiculous to anyone who has looked into the literature of religion or mythology or folklore or science fiction or science itself, is what the creationists call the "two-model" approach. It reflects their strategy of depicting biblical tales and scientific theories as comparable alternatives, and it greatly simplifies their work. It sets a stage on which they can claim any uncertainty in science—any unanswered question, any disagreement about the interpretation of data—as a point in favor of pseudoscience.

When that tactic won't serve, the creationists turn to two others. They promulgate pseudohypotheses that explain scientific observations in ways that can never be analyzed, or they invoke falsehoods.

To illustrate how creation pseudoscientists apply these principles, I offer a few assertions that they have brought forth in publications or in debates:

- Biologists can't explain the celestial-navigation abilities of certain birds, so those abilities must have been conferred by the biblical creator.

- Biologists disagree about the classification and physical attributes of some fossil hominids, so the idea that man and apes share a common ancestor is merely a conjecture unsupported by evidence.

- Biologists assert that evolutionary changes arise by chance, but chance couldn't have produced the high degree of

order seen in extant organisms. (This is a half-truth. Evolution does indeed involve random events, but these constitute only a part of the picture. The other part is selection—the process by which the results of random events are tested against a great array of environmental gauges. This process isn't random at all. It is highly ordered, and it generates the biological order that creationists find so stupefying.)

- Studies of radioactive decay in rocks have indicated that Earth is billions of years old, but Earth's age is really only a few thousand years. The studies are flawed: They rely on assumptions that rates of decay are constant, but the rates are in fact variable. (This is a hundredth-truth. At extreme temperatures and pressures, some rates change by a few percent. The errors that such changes might introduce into an inferred age of Earth are trivial, and they can't fill the gap between an age measured in billions of years and an age measured in thousands.)

- The fossil record provides no evidence of one organism's gradually changing into another. (This is simply false. Paleontologists have in hand various sequences of fossils that demonstrate gradual change quite unambiguously. Each comprises a series of successively modified forms that continuously link a progenitor species to one or more descendant species.)

- Anatomical homologies—for example, the correspondence of bones in the forelimbs of a man, a horse, and a bat—don't imply common ancestry or evolutionary descent. They simply show that the organisms were created by a god who adopted a single plan but varied the plan so that each organism would be "perfectly equipped" to take its place in the world. (This notion, taken from a book issued by the Creation Research Society, exemplifies the assertions that creationists offer as hypotheses. But it isn't a hypothesis at all: It can't be supported or contradicted by any findings of science, because it posits a supernatural entity that is necessarily beyond the ken of science.)

- The stratigraphic distribution of fossils shows that they are vestiges of organisms that perished in a worldwide flood

and were entombed in sediments that the flood generated. The flood left fossils of bottom-dwelling marine invertebrates in very low strata because these animals were least able to evade the sediments pouring into the ocean basins. It left fish fossils in somewhat higher strata because fishes lived at lesser depths and were able to avoid the sediments for a longer period of time. It combined fossils of amphibians, reptiles and land plants in still higher strata, because those organisms were buried at shorelines that weren't engulfed until the ocean basins had been filled entirely. And so forth. (This desperate nonsense doesn't explain why whole classes of immobile marine invertebrates are absent from the lowest strata but present in higher ones. It doesn't explain why marine mammals don't appear in the strata that bear fishes. It pretends that the lowest strata showing land plants also show reptiles and amphibians, but this is simply false. And so forth.)

- The apparent evidence that Earth is old isn't evidence at all. Earth was created by a god who decided to make it look old by filling it with signs of events that had never occurred. (This is the best pseudohypothesis of all—universal, beyond analysis, and designed to counteract all data and all reason. It is at least 120 years old, having been promoted by the pious British naturalist Philip Gosse in a book called *Omphalos: An Attempt to Untie the Geological Knot*. Barber¹¹ provides an amusing summary of Gosse's speculation that the biblical god had fashioned evidence of a fictitious past, including navels on the bellies of newly created humans and growth rings in the tissues of newly created trees. As far as I know, neither Gosse nor any of the modern creationists has answered an obvious objection to all this: Even if we imagine a god who enjoys jokes, we have no reason to think that he embodied the jokes in the physical world and revealed the real story in the Bible. He might have done the reverse.)

- Scientists have refused to give a fair hearing to the evidence for creation. (This is not merely untrue but an outrage against reason and history alike. Scientists have given the biblical stories of creation a

hearing that was not merely fair but unabashedly sympathetic. It was held during the nineteenth century. It began at a time when the scientific establishment acknowledged the Bible as the framework for the study of nature. It continued through a time when eminent scientists gave their intellects and their prestige to defending that framework against contrary data. It ended only when the defense was obviously hopeless.¹² The creationists who today pretend or imagine that they have been abused are oblivious to that history, ignorant of it, or ignorant of the purposes of science.)

By any standard, "creation science" is a fraud—nothing more and nothing else. And even Duane Gish, one of the luminaries of the Institute for Creation Research, has said so. His confession appears in a book that he issued in 1979, and it leaves no room for doubt:

Creation. By creation we mean the bringing into being of the basic kinds of plants and animals by the process of sudden, or fiat, creation described in the first two chapters of Genesis. Here we find the creation by God of the plants and animals, each commanded to reproduce after its own kind using processes which were essentially instantaneous.

We do not know how God created, what processes he used, for God used processes which are not now operating anywhere in the natural universe. This is why we refer to divine creation as special creation. We cannot discover by scientific investigations anything about the creative processes used by God.¹³

IF CREATION pseudoscience is ludicrous in content and fraudulent in intent, why is it useful to the creationists? Why have they been able to peddle it all over the country to support their demands for equal time?

There are several reasons, all connected by a common thread: ignorance.

Like it or not, the general population of the United States is composed of people who know precious little about the history and content of modern science, and precisely nothing about its precepts and methods. And one of the most dramatic measures of the prevailing ignorance is the popularity of biblical supersti-

tion—not only among active creationists but in the population at large. Consider a report that appeared in 1982 in the *New York Times*:

The American public is almost evenly divided between those who believe that God created man in his present form at one time in the past 10,000 years, and those who believe in evolution or an evolutionary process involving God, according to the Gallup Poll. . . .

The finding dismayed some prominent religious leaders, who said, among other things, that human existence on earth is much older than 10,000 years, but the results came as no surprise to a leading anthropologist.

Of the participants in the poll, 44 percent, nearly a quarter of whom were college graduates, said they accepted the statement the "God created man pretty much in his present form at one time within the past 10,000 years. . . ."

Nine percent agreed with the statement: "Man has developed over millions of years from less advanced forms of life. God had no part in this process." Thirty-eight percent said they agreed with the suggestion that man has developed over millions of years from less advanced forms of life, but God guided this process, including man's creation." Nine percent of those interviewed said they did not know. . . .

Bishop John S. Spong, the Episcopal Bishop of Newark, said he did not know of a single reputable biblical scholar who would say that God created man in the last 10,000 years, "since there is an enormous amount of evidence to the contrary." He called the poll's findings a "sorry reflection" on academic achievement in this country. . . .¹⁴

In such a setting, creation pseudoscience has considerable utility. It serves for hoodwinking teachers and school officials whose own knowledge of science is so scanty that they can't recognize the creationists' falsehoods or perceive the speciousness of the creationists' entire construct. It gives to politicians and administrators an excuse for yielding to the demands of ignorant constituents. And it gives to ignorant politicians a mechanism for defending their backwardness and for courting voters who are as backward as they. Hence this utterance by a candidate for president in 1980:

In recent years [evolutionary biology] has been challenged in the world of science. If evolution-

ary theory is going to be taught in the schools, then I would think that also the biblical theory of creation, which is not a theory but the biblical story of creation, should also be taught.¹⁵

I know of no more concise statement of the creationists' political syllogism: a false assertion about science, then a false conclusion that displays a banal, mindless egalitarianism.

The appeal to egalitarianism is the second element in the creationists' grand strategy. It exploits the same general ignorance and executive cowardice that lend power to creation pseudoscience.

Nelkin⁷ cites several cases in which school officials wrapped themselves in the flag of equity and ruled that creationist nonsense should be presented in classrooms, so that students could "choose" or "weigh the information and arrive at their own conclusions" or something like that. Each such case, no matter how it arose, represents an explicit abdication of intellectual leadership. I can imagine that these self-debased educators have delegated to their students any number of other choices—a choice between the heliocentric and the geocentric model of the solar system, perhaps; or between the microbiological and the demonistic explanation of infection; or between the bacterial and the menstrual interpretation of the souring of milk.

In Dallas, Atlanta, and Chicago, school boards have granted to creationists equal time in science classes; they also have authorized schools to buy creationistic books and pamphlets for use as required reading or as supplementary reading in courses. In Mississippi and Indiana, creationist texts have been accepted as books that those states will buy for local school districts.¹⁶

In California, the state is paying for life-science textbooks that show the alternative response to creationism: achieving equity by spurning science and creationism equally. Though their diligent avoidance of evolutionary biology, these books become sophistic and grotesque. One of them consigns evolution to three paragraphs at the end of its chapter about heredity.¹⁷ It defines evolution as "the process of change in a population as its gene

pool changes"; it notes that such a change may improve the population's chance for survival; and it says nothing more—nothing to suggest that this process has shaped all the life on Earth, or that the recognition of this process has shaped all of modern biology, or that Darwin ever lived. Another book¹⁸ omits evolution entirely. It doesn't even mention the word.

Other examples abound, but I think that these suffice to show that the creationists' campaign for government by the ignorant and for the ignorant has enjoyed some substantial successes. Let me now cite a telling event, recounted by Nelkin, that suggests the depth of the ignorance on which these successes have been built. It occurred in California in 1972, after the State Board of Education had accorded to creationists some concessions that the creationists considered to be inadequate:

[The creationists] began to gather survey material to prove the extent of public support for their views. The Seventh Day Adventist Church of Crescent City, California, polled 1,500 adults, about 57 percent of whom attended church. They claimed that 91 percent of church attenders and 85 percent of [those who didn't attend] favored teaching creation in the public schools. Fifty-four percent of church attenders and 65 percent of nonattenders also favored the teaching of evolution [The Adventists] respectfully submitted their findings in support of "equal time" to the board of education as a form of "public service" in order to help the board "represent our community."

I suspect that at least some of those people were sincere. I suspect that they really imagined that the scientific worth of an idea had something to do with its popularity, and that the objective of science education was not to confer knowledge or to stimulate thought but to "represent our community." And I am reminded of a passage from the autobiography of the biologist and Nobel laureate Salvador Luria:

More distressing [than the creationists' attempts to control education] . . . is what the wide support for such nonsense as creation science (as distinct from biblical scholarship) means in terms of the position of science in the culture of our supposedly scientific society. In fact, our society is permeated not by science, but

by an exploitative distortion of science-based technology, as irrational as the irrational aspects of religion. Science itself . . . is probably as alien to the majority of people in American society as it was to the Hebrews of the Old Testament. Despite a plethora of science writers and reporters, the methods and beauty of science have remained concealed from the majority of the people. This majority includes those legislators, in Arkansas and elsewhere, who see no contradiction between a belief in a biblical universe six thousand years old and the presence of million-year-old oil deposits whose exploitation by special interests they are elected to protect.¹⁹

WITH LURIA'S reference to Arkansas, I return to the trial that was held in Little Rock in December 1981, in the United States District Court for the Eastern District of Arkansas. At issue was the survival of Act 590 of the Acts of Arkansas of 1981, certainly the most important piece of creationist legislation to be adopted in this country in the past fifty years.

Act 590 had been derived, by a tortuous succession of steps, from a document that the Institute for Creation Research had offered as a model for a resolution to be adopted by school boards. That document was transformed into a model law chiefly through the efforts of Paul Ellwanger, a respiratory therapist who dwelt in South Carolina and believed that evolutionary biology was the precursor of Nazism and abortions, among other things. Ellwanger promoted his product diligently, and he eventually saw it introduced into more than twenty state legislatures. In all but Arkansas's it was blocked in a committee or allowed to expire at the end of a session. The Arkansas legislature passed it in March 1981, and Governor Frank White signed it into law without reading it.²⁰

The text of the act was short and vicious. It ordered that public schools in Arkansas must give "balanced treatment" to "creation-science" and "evolution-science," and it defined each of those hyphenated concepts. The definition of creation-science, given in the act's Section 4(a), said:

"Creation-science" means the scientific evidences for creation and inferences from those evidences. Creation-science includes the scientific evidences and related inferences that indicate: (1) Sudden creation of the universe, energy, and life from nothing; (2) The insufficiency of mutation and natural selection in bringing about development of all living kinds from a single organism; (3) Changes only within fixed limits of originally created kinds of plants and animals; (4) Separate ancestry for man and apes; (5) Explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood; and (6) A relatively recent inception of the earth and living kinds.

In other words, creation-science would promote biblical beliefs that had been edited with an eye to the First Amendment. It would offer a creation without a Creator, a lower-case flood instead of a great mythical Flood, and a biological taxonomy based on the "kind" — a word that has no technical meaning in biology and that had been adopted from the King James version of the Bible.

The plaintiffs who sued to have the act nullified included the resident Arkansas bishops of four churches, various officials of several other churches, parents and friends of schoolchildren, a high-school biology teacher, several Jewish organizations, and the National Association of Biology Teachers. They were represented by the American Civil Liberties Union.

The defendants, seeking to have the act sustained, included the Arkansas Board of Education and the committee that chooses textbooks for Arkansas's schools. Their defense was led by Steven Clark, Arkansas's attorney general.

The trial spanned eleven days, and it was distinctly one-sided.

The plaintiffs presented witnesses who were experts in religion, in science, or in education, and they made a case that had three major parts. The first emphasized religion, seeking to prove that creation pseudoscience is just a collection of biblical beliefs in a new guise. The second part dealt with science and had two objectives: showing that creation pseudoscience isn't a science, and showing that the authors of Act 590 had failed to understand the evolutionary biology that they had sought to

countervail. The third part emphasized education, seeking to demonstrate the theoretical and practical difficulties of translating Act 590 into practice.²¹

The defense offered witnesses who seemed to be experts in nothing but creationist sophisms, and who rather consistently eroded the dogmas that they were seeking to defend. Lest that seem to be an overly harsh summary, let me quote from two reports of the trial.

In an account written for Harper's,²² Gene Lyons judged that the defense's most coherent witness by far was Dr. Norman Geisler of the Dallas Theological Seminary. It was Geisler who admitted, under cross-examination, that besides the two-model theory, he also believed that UFO's were "a satanic manifestation in the world for the purpose of deception." . . .

After Geisler, the state's case went straight downhill. . . . Most [of the defense witnesses] were like Donald Chittick, a physical chemist from George Fox College in Newberg, Oregon. Chittick spent hours telling the court how fuel could actually be made very rapidly from "biomass" materials. . . . To Chittick's mind, this proves that the world does not have to be 4.5 billion years old at all. Chittick's most telling point was that the amount of helium present in the earth's atmosphere indicates that radioactive decay has been taking place on earth for about 10,000 years only. That is just about how old creationists say the earth is. Either Chittick did not mention, or does not know, that helium is too light to be held by earth's gravity and disperses constantly into space.

The trial's only poignant moment came during cross-examination of Harold Coffin, a dreadfully earnest Seventh-Day Adventist who spends his time floating horsetail ferns in tanks of water to demonstrate that their fossilized ancestors found standing upright in coal seams hundreds of feet thick could have floated to that position during Noah's flood. Coffin was asked to say how old the earth would seem to a person unaided by Scripture, and considering only the available scientific evidence. . . . As old as evolutionists claim, he said, about 4.5 billion years.

Roger Lewin, writing for Science,²³ described the examination of two witnesses who sought to bolster some creationist fantasies about organisms:

Wayne Frair is a zoologist at The King's College, Briarcliff Manor, New York, and a member of the Creation Research Society . . .

During his testimony, Frair had propounded his "limited change model." In other words, a small degree of evolutionary change is possible, but this is within the limits of "the originally created kinds." . . . [Bruce Ennis, a lawyer for the plaintiffs] therefore directed part of his cross-examination to the question of kinds.

Q. How many originally created kinds were there?

A. Let's say 10,000 plus or minus a few thousand.

Q. Some creationists believe kinds to be synonymous with species, some with genera, some with family, and some with order, don't they?

A. (Frair began a long dissembling answer which Ennis cut short by repeating the question.)

A. The scientists with whom I am working . . . well . . . It tends more toward the family. But it may go to order in some cases.

Q. You have been studying turtles for many years, haven't you?

A. Yes.

Q. Is a turtle an originally created kind?

A. I'm working on that.

Q. Are all turtles within the same created kind?

A. That's what I'm working on.

Frair was not alone among the witnesses in being unable to define "kind" or to say how their organisms of study might fit into the concept. . . .

[Chandra] Wickramasinghe, an Indian mathematician working at the University College of Wales, Cardiff, had been flown in by the attorney general's office to be the star witness. . . .

The Creator, said Wickramasinghe, dispersed microorganisms throughout interstellar space, whereupon they were able to seed planets such as Earth once they had been caught up in the tails of comets. Not only was life seeded in this way, but the only possibility of major evolutionary jumps occurring, he contended, was if new genes rained down on earthly organisms and became incorporated in their genomes. . . .

[David Klasfeld, the plaintiff's lawyer who cross-examined Wickramasinghe] asked

the witness to read a passage from his latest book, *Evolution from Space* [written in collaboration with the astronomer Fred Hoyle.] In the passage, the authors state that it is possible that insects are in fact smarter than humans but are being careful not to let on.

Cross-examination closed with the witness undermining the case of the team who paid his air fare to Little Rock.

Q. Could any rational scientist believe that the earth's geology can be explained by a single catastrophe?

A. No.

Q. Could any rational scientist believe that the earth is less than one million years old?

A. No.

When Judge William R. Overton wrote his decision, he showed uncertainty about the defense's purpose in recruiting Wickramasinghe:

Perhaps it was because he was generally critical of the theory of evolution and the scientific community, a tactic consistent with the strategy of the defense. Unfortunately for the defense, he demonstrated that the simplistic approach of the two model analysis of the origins of life is false. Furthermore, he corroborated the plaintiff's witnesses. . . .

Overton's decision is a fine work, and you should read every word of it.²⁴ In a clear and direct style, Overton distills the history of creationism, the origin of Act 590, the intellectual principles of science, the falsity of the creationists' scientific pretensions, the speciousness of their re-

course to public opinion, and the inevitable conclusion that Act 590 was an attempt to establish religion. Listen:

Creation science as described in Section 4(a) fails to meet [the essential characteristics of science]. First, the section revolves around 4(a)(1) which asserts a sudden creation "from nothing." Such a concept is not science because it depends on a supernatural intervention which is not guided by natural law. It is not explanatory by reference to natural law, it is not testable and is not falsifiable.

If the unifying idea of supernatural creation by God is removed from Section 4, the remaining parts of the section explain nothing and are meaningless assertions. . . .

Section 4(a)(5) refers to "explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood." This assertion completely fails as science. The Act is referring to the Noachian flood described in the Book of Genesis. . . .

The methodology employed by creationists is another factor which is indicative that their work is not science. A scientific theory must be tentative and always subject to revision or abandonment in light of facts that are inconsistent with, or falsify, the theory. A theory that is by its own terms dogmatic, absolutist, and never subject to revision is not a scientific theory.

The creationists' methods do not take data, weigh it against the opposing scientific data, and thereafter reach the conclusions stated in Section 4(a). Instead, they take the literal wording of the Book of Genesis and attempt to

find scientific support for it. . . .

The application and content of First Amendment principles are not determined by public opinion polls or by a majority vote. Whether the proponents of Act 590 constitute the majority or the minority is quite irrelevant under a constitutional system of government. No group, no matter how large or small, may use the organs of government, of which the public schools are the most conspicuous and influential, to foist its religious beliefs on others. . . .

If I were asked to submit just one document to an honest school board that was confronting a cohort of creationists, I would send a copy of this decision.

The Arkansas trial was a significant victory of intellect over dogma and overt foolishness, and a good part of its significance sprang from its being reported extensively in scientific publications and in the popular press. A comparison to the Scopes trial is inescapable here.

But in one sense, the Arkansas affair was minor. Creationists aren't well adapted to federal courts, where intelligent adversaries can easily show them up, and they knew this long before they made their case in Little Rock. They are much safer when they act to abuse school boards, curriculum committees, and textbook-publishers. By these endeavors they already have gained more power over education than they ever could have got by winning in Arkansas.

1. N.M. Sarna. 1970. *Understanding Genesis*. Schocken Books. New York. xxx + 267 pp.

2. R. Cavendish, editor. 1980. *Mythology: An Illustrated Encyclopedia*. Rizzoli International Publications, Inc. New York. 303 pp.

3. M. Hadas. 1956. *A History of Rome*. Doubleday & Co., Inc. Garden City, New York. vi + 305 pp.

4. The Bible offers no statement about the age of Earth. The notion that Earth is young proceeds from calculations in which the lifespans of biblical patriarchs were summed. The most famous of these calculations was published in 1650 by the Irish archbishop James Ussher. He concluded that Earth had been created in late October, 4004 years before the reported birth of Jesus. This result, which has been printed as a marginal note in many editions of the Bible, has acquired the force of scripture among the especially credulous.

5. R. Lewin. 1984. Creationism survives in Louisiana legislature. *Science* 225:36.

6. Anon. 1985. *Life—How Did It Get Here?* Watchtower Bible and Tract Society of New York, Inc., and International Bible Students Association. New York. 255 pp.

7. D. Nelkin. 1977. *Science Textbook Controversies and the Politics of Equal Time*. MIT Press. Cambridge, Massachusetts. xi + 174 pp.

A second edition of this book was issued in 1984 under a different title: D. Nelkin. 1984. *The Creation Controversy*. Beacon Press. Boston, Massachusetts. 242 pp.

8. The court wouldn't permit Darrow to call evolutionists as witnesses, so Darrow called instead an eminent creationist: his opponent Bryan. The ensuing examination, in which Darrow concentrated on Bryan's personal beliefs, evoked Bryan's

celebrated denial that man was a mammal and his notorious assertion that the King James version of the Bible was absolutely accurate, even in its typographical errors.

Reports in the popular press transcended the courtroom and gave considerable attention to, among other things, the creationist mob that had converged on the town where the trial was held. For a sample, see the essay "Inquisition" in: H.L. Mencken. 1947. *The Days of H.L. Mencken*. Alfred A. Knopf, Inc. New York.

9. R.L. Numbers. 1982. Creationism in 19th century America. *Science* 218:538.

10. J.V. Grabiner and P.D. Miller. 1974. Effects of the Scopes trial. *Science* 185:832.

11. L. Barber. 1980. *The Heyday of Natural History*. Doubleday & Co., Inc. Garden City, New York. 320 pp.

12. Barber (note 11) provides a bright, eminently readable survey of the early hegemony and eventual collapse of biblical literalism in nineteenth-century science. For more detailed accounts, see:

N.C. Gillespie. 1979. *Charles Darwin and the Problem of Creation*. University of Chicago Press. Chicago. xiii + 201 pp.

A. Desmond. 1984. *Archetypes and Ancestors*. University of Chicago Press. Chicago. 287 pp.

13. D.T. Gish. 1979. *Evolution: The Fossils Say No!* 3rd edition. Creation-Life Publishers. San Diego, California. 198 pp. (emphasis in original)

14. R. Severo. 29 August 1982. Poll finds Americans split on creation idea. *New York Times*.

15. Ronald Reagan, quoted by Gene Lyons. See note 22.

16. R.A. Gallant. To hell with evolution. In: A. Montague, editor. 1984. *Science and Creationism*. Oxford University Press. New York.

17. W.L. Smallwood. 1978. *Life Science*, 2nd edition. Webster Division, McGraw-Hill Book Co. New York. xi + 468 pp.

18. J.L. Carter et al. 1979. *Life Science*, revised edition. Ginn and Co. Lexington, Massachusetts. vii + 408 pp.

19. S.E. Luria. 1984. *A Slot Machine, A Broken Test Tube*. Harper & Row, Publishers, Inc. Cambridge, Massachusetts. x + 228 pp.

20. R. Lewin. 1982. A tale with many connections. *Science* 215:484.

21. M. Ruse. A philosopher's day in court. In: A. Montagu, editor. 1984. *Science and Creationism*. Oxford University Press. New York. (This is a first-person memoir of the trial. Ruse testified for the plaintiffs.)

22. G. Lyons. 1982. Repealing the enlightenment. *Harper's* 264(1582):38.

23. R. Lewin. 1982. Where is the science in creation science? *Science* 215:142.

24. The decision can be found in the *Federal Supplement: McLean v. Board of Educ.*, 529 F. Supp 1255 (E.D. Ark. 1982). It has been reprinted in a number of publications that the ordinary reader can obtain more easily, e.g., *Science* 215:934.

CONFRONTING THE ARMIES OF THE NIGHT

Three new publications tackle creation pseudoscience and the creationists' campaign to control the schools.

Science and Creationism. Ashley Montagu, editor. 1984. Oxford University Press. New York. 415 pp.

Science and Creationism: A View from the National Academy of Sciences. James D. Ebert et al. 1984. National Academy Press. Washington, D.C. 28 pp.

Evolutionists Confront Creationists. Frank Aurbrey and William Thwaites, editors. 1984. Pacific Division, American Association for the Advancement of Science. San Francisco, California. 213 pp.

CONTEMPORARY creationism has been an identifiable political force in the United States for some twenty-five years. During most of that time, the scientific community's reaction to it has been reluctant and weak. Because the creationists' doctrine was foolish, too many scientists imagined it to be impotent as well. Because the creationists themselves were ignorant, too many scientists imagined them to be inept. Too few recognized that ignorant zealots could win handily if issues were political rather than intellectual.

The past few years have brought a palpable change in the prevailing scientific attitude, and this change can be attributed in part to events in Arkansas in 1981. Press reports about Arkansas's equal-time statute, and about the trial that the statute engendered (see page 11), exposed the creationists' political apparatus and political strength in a way that overcame complacency and contempt alike.

Whether for that or other reasons, more scientists have come to appreciate the strength and insidiousness of creationism, and they have joined in fashioning an intelligent response. Three recent publications deserve consideration as parts of that response.

IN *Science and Creationism*, Ashley Montagu has assembled twenty-one articles that together provide a broad view of contemporary creationism and the disputes it has generated. Some of the articles outline creationism's history and tenets; some refute specific aspects of creation pseudoscience; some consider the social and intellectual implications of the creationists' attacks on science education; and some describe and explain the Arkansas trial.

George M. Marsden's contribution, "Understanding Fundamentalist Views of Science," is skillful, readable, and true to its title. Marsden examines the cultural roots of fundamentalism in a way that is sympathetic and engaging, suggesting why the adjustment of religion to science in the later years of the nineteenth century was neither universal nor stable, and why it was in some ways more apparent than real. If you have wondered why or how creationists can believe what they believe, you will find this essay enlightening.

Of the several articles that address scientific questions raised by the creationists, three seem especially good:

Kenneth R. Miller's "Scientific Creationism Versus Evolution" deals largely with evidence and analyses that have elucidated the age of Earth. Miller writes very well, brings clarity and even humor to a subject that some laymen find difficult, and points out how thoroughly the creation pseudoscientists have misunderstood and misrepresented the information in hand.

L. Beverly Halstead's piece is called

"Evolution—The Fossils Say Yes!" (The title mocks a creationist's book in which the fossils said *no*.) Halstead considers some of creation pseudoscience's statements about the fossil record, and he shows that each is either a lie or a semantic trick. Among the tricks that he notes is the creationists' persistent declaration that scientists have no fossil organism that stands as an intermediate between two major groups—say, reptiles and mammals—but belongs to neither. That declaration is right. Scientists have no such organism because their system of classification precludes it. Given a series of organisms that show various combinations of reptilian and mammalian features, the taxonomist invokes some particular feature (or suite of features) as definitive: If an organism shows that feature, the organism is classified as a mammal; if not, it is classified as a reptile. To anyone who comprehends this, the absence of a free-standing intermediate, called neither mammal nor reptile, is not a weighty fact of nature but a mundane artifact of taxonomy.

Stephen Jay Gould's "Evolution as Fact and Theory" deals partly with semantics too. Gould explains what scientists mean by *theory*, observes how creationists play on the public's misunderstanding of the technical definition of that word, and describes how creation pseudoscientists have distorted and exploited the current debates among theorists about the tempo of evolution.

Among the articles that contemplate the social aspects of creationism, the most stimulating is one by Isaac Asimov: "The 'Threat' of Creationism." Toward the end of it, Asimov presents a forceful interpretation of the creationists' campaign to have their superstitions presented beside science in public-school classrooms. The real danger, he says, lies in the mechanism by which the creationists want to obtain their equal time:

In the scientific world, there is free and open competition of ideas, and even a scientist whose suggestions are not accepted is nevertheless free to continue to argue his case.

In this [competition], creationism has clearly lost. It has been losing, in fact, since the time of Copernicus four and a half centuries ago. But creationists, placing myth above reason, refuse to accept the decision and are now calling on the government to force their views on the schools in lieu of the free expression of ideas. Teachers must be forced to present creationism as though it has equal intellectual respectability with evolutionary doctrine.

What a precedent this sets.

If the government can mobilize its police-men and its prisons to make certain that teachers give creationism equal time, they can next use force to make sure that teachers declare creationism the victor so that evolution will be evicted from the classroom altogether.

We will have established the full groundwork, in other words, for legally enforced ignorance and for totalitarian thought control.

Before you judge Asimov's scenario to be extreme, recognize that what the creationists are demanding now is that the schools practice and teach doublethink. I have chosen that word carefully, and I am mindful of Orwell's description:

Doublethink means the power of holding two contradictory beliefs in one's mind simultaneously, and accepting both of them. The Party intellectual knows in which direction his memories must be altered; he therefore knows that he is playing tricks with reality; but by the exercise of doublethink he also satisfies himself that reality is not violated. . . . To tell deliberate lies while genuinely believing in them, to forget any fact that has become inconvenient, and then, when it becomes necessary again, to draw it back from oblivion for just so long as it is needed, to deny the existence of objective reality and all the while to take account of the reality which one denies—all this is indispensably necessary. . . .

That is precisely the import of equal-time statutes and equal-time policies. They require schools to profess simultaneously that all living things seem to have arisen from a common progenitor and that all living things seem to have had separate origins. They require students to understand simultaneously that Earth

seems to be an ancient object shaped by natural forces during billions of years and that Earth seems to be a young object shaped by magic a few thousand years ago. And so on.

And where does this lead? You may infer the answer from the last sentence of Orwell's exposition:

Ultimately, it is by means of doublethink that the Party has been able—and may, for all we know, continue to be able for thousands of years—to arrest the course of history.

The advocates of doublethink suffered badly in the Arkansas trial, and *Science and Creationism* presents several articles that tell why. Roger Lewin's "A Tale with Many Connections" describes the origin of the Arkansas equal-time statute and the affiliations and goals of its sponsors. The story is revealing and complicated; Lewin does an admirable job in telling it. Gene Lyons's "Repealing the Enlightenment" is a lively, caustic, interpretive report of the trial itself, emphasizing some of the clownish performances by the creationists' witnesses. Lyons offers as a prelude an aphorism by H.L. Mencken; then he writes a text that is reminiscent of that master's reporting of the prosecution of John Scopes in 1925. But the best piece about the trial is "Decision of the Court"—the whole text of the decision by which Judge William R. Overton struck the Arkansas statute down. Montagu has served his reader well by reprinting Overton's compelling analysis.

Science and Creationism is a book for the intelligent layman, and such a reader will find it valuable. It has, however, three important flaws, all arising from Montagu's indifferent editing. First, certain pairs of articles show extensive redundancy that a more conscientious editor would have eliminated. Secondly, two of the articles—Roger J. Cuffey's "Paleontologic Evidence and Organic Evolution" and Sidney W. Fox's "Creationism and Evolutionary Protobiogenesis"—are so technical in their content and so academic in their style that they don't belong here; Montagu should have asked their authors to rewrite them, or he should have omitted them. Finally and inexcusably, the book has no index.

THE SIMILARLY titled *Science and Creationism: A View from the National Academy of Sciences* is a booklet prepared by the Academy's Committee on Science and Creationism, under the chairmanship of James D. Ebert, as a definitive response to the teaching of creationism in science classrooms. The Academy has distributed some 40,000 copies to school-district officials, teachers, and others whose work affects education.

The text discusses five major subjects: the nature of science, the origin of the universe and of Earth, biological evolution, the evolution of man, and the origin of life. Throughout, Ebert and his colleagues concentrate on presenting scientific evidence and showing how scientists think about such evidence. They explain how the information in hand supports current scientific interpretations, and they summarize reasons why that information doesn't support creationism, though they don't undertake a detailed refutation of the creationists' view of each body of evidence. Their writing consistently conveys a tone of restraint as it moves toward this final statement:

It is, therefore, our unequivocal conclusion that creationism, with its accounts of the origin of life by supernatural means, is not science. It subordinates evidence to statements based on authority and revelation. Its documentation is almost entirely limited to the special publications of its advocates. And its central hypothesis is not subject to change in light of new data or demonstration of error. Moreover, when the evidence for creationism has been subjected to the tests of the scientific method, it has been found invalid.

No body of beliefs that has its origin in doctrinal material rather than scientific observation should be admissible as science in any science course. Incorporating the teaching of such doctrine into a science curriculum stifles the development of critical thinking patterns in the developing mind and seriously compromises the best interests of public education. This could eventually hamper the advancement of science and technology as students take their places as leaders of future generations.

The entire booklet is exemplary in its organization, its frugal style, and its clar-

ity of phrase—a fine piece of science writing. If you are interested in science education, or if you just would like to read a skillful and current summary of the scientific view of origins, you should read this work. It costs \$4.00, and it can be ordered from the National Academy Press, 2101 Constitution Avenue, N.W. Washington, D.C. 20418.

THE COLLECTION *Evolutionists Confront Creationists* presents nine papers—seven by scientists and two by creation pseudoscientists—that were given in June 1982 at a symposium sponsored by the Pacific Division of the American Association for the Advancement of Science.

Several of these papers are outstanding, and one is truly remarkable: "The Scientific Case For Creation," contributed by the creationist Duane T. Gish.

Gish's offering is a thirteen-page recitation of some of the principal themes and propositions of creation pseudoscience. I call it a *recitation* because that is what it is—a set piece about imaginary deficiencies in the fossil record and about the improbability of life's emerging from nonliving matter. What makes it remarkable is its ostensible naiveté. Gish never even tries to address contrary facts and interpretations that certainly were known to many of the people who attended the symposium. With startling insouciance he declares that the apparent absence of life on Mars shows that life couldn't have arisen by natural processes on Earth, and then he presents a fantasy about fossils as if nobody knows that it is nonsense: "I think all of you," he says, "are aware of the fact that we do not find any record of gradual change of one creature into another." But strangest of all is his addled invocation of physics. This is an important item in creation pseudoscience, and it merits some special attention.

The creationists assert that life couldn't have originated spontaneously because natural systems spontaneously run "downhill," from a more ordered state to a less ordered one. The formation of a living thing from simple chemicals, they say, would require a system that ran in the

opposite way, deriving a more ordered state from a less ordered one.

This assertion is a patent misuse of a scientific principle called the second law of thermodynamics. (Thermodynamics is a branch of physics. Its concerns include processes in which energy is converted from one form to another—for example, from heat into mechanical work.) The second law does indeed say that every system, taken as a whole, tends to lose order and become simpler. But it also allows that energy transferred into or within a system may cause particular parts of the system to gain order and become more complex.

Gish is (or pretends to be) unaware of the latter point, and he assumes that his audience shares his ignorance. To illustrate his interpretation of the second law, he brings forth the observation that one must work hard to straighten a messy room, but the room soon becomes messy again; in other words, it loses order. And he says nothing more. A proper analysis would have continued: By transferring energy to the disarrayed objects in the room, one can make the room tidy again. In fact, one can make it even tidier and more ordered than it was after the first straightening.

I can easily imagine Gish's presenting his codswallop about the second law to feckless school boards or to untutored legislators, but I can hardly believe that he offered it to an audience of scientists. Gish's paper presumably represents his best shot, his most studious attempt to support his dogmas with scientific resources; and it shows that he has none.

For the reader who wants to learn more about thermodynamics and about the creationists' abuse of thermodynamic principles, *Evolutionists Confront Creationists* provides a paper by John W. Patterson of Iowa State University. It is called "Thermodynamics and Probability," and it is excellent. Patterson starts with some observations about the nature of scientific laws and theories, builds lucid explanations of the three major divisions of thermodynamics, and shows how each division provides insights that don't support creation pseudoscience but impeach it.

His writing is always clear, his use of examples is adroit, and his outrage is evident: Patterson believes that the creationists' perversion of thermodynamics is attributable not to ignorance but to deceit, and he says so.

Equally engaging is the wryly titled paper by William Thwaites of San Diego State University: "Design: Can We See the Hand of Evolution in the Things It Has Wrought?" Thwaites addresses the most hallowed precept of the creationists' view of living things: that the complexity and structural integration of living organisms bespeak an intelligent designer.

This belief is ancient, but it was promoted to greatest effect only 200 years ago, by the English churchman William Paley. Paley issued in 1802 a book called *Natural Theology*, in which he recommended the study of nature as a way of apprehending the existence and attributes of a creative god. These could be inferred from the examination of living things, Paley said, because the physical intricacies of organisms tell of skillful design as certainly as do the physical intricacies of a watch. One result of Paley's analogizing was the pervasive popularity of natural history in Britain during the nineteenth century. It produced a large and bizarre subculture of amateur naturalists who saw field trips as acts of piety, observed perfection in every organism's morphology, discerned a supernatural purpose in every organism's way of life, and found unlimited proof that man was the paragon and the ordained master of the organic world.

Such deliberations about design persist and abound in contemporary creationism. Thwaites sets against them some evidence for a contrary view: that organisms are not perfect but merely workable, that they make do with mediocre mechanisms, and that they carry loads of extraneous features left over from earlier approaches to workability.

In one example, he compares the eye of a squid with the eye of a human. The two organs are strikingly similar, but they also show a striking difference. In the squid eye, the retina's nerves and blood vessels lie behind its photosensitive elements, so

light can travel to those elements directly. The human eye shows the opposite arrangement: The retinal nerves and blood vessels lie in front of the photoreceptors, and light must pass through them before it can be detected. Moreover, there is a blind spot where the nerves and blood vessels penetrate the retina on their way out of the eye.

"Certainly," Thwaites comments, "the creationists need to explain why we got the inferior design. I had thought that people were supposed to be the Creator's chosen organism."

In a similar spirit, he asks the creationists about the transitory teeth of the baleen whales:

The very existence of whales must be an embarrassment to the creationists, for the whales have many . . . examples of evolutionary make-do adaptations to their watery habitat. The great mysticete whales use baleen plates as sieves to catch huge quantities of small organisms. They neither need nor have teeth. As foetuses, however, they develop a full set of teeth. . . . If foetal baleen whale teeth were designed by an omnipotent Creator, just what was He thinking of? They never erupt through the gums and they are completely resorbed before birth. They certainly are never used for chewing. The creationists owe it to the rest of the world to tell us just what it is that these teeth do, so that we might appreciate the intelligence and purposefulness of this design.

Will the creationists offer a reasoned reply? No, they won't. Nor will they respond to the thermodynamicist Patterson or the other scientists whose papers in this volume refute other creationistic assertions about nature. They won't respond because reasoned discourse can only make more obvious the foolishness of their beliefs; it certainly can't advance their program, because that program explicitly rejects intellectual processes and relies on

political ones.

This brings me to Robert Scott Root-Bernstein's admirable essay "Ignorance Versus Knowledge in the Evolutionist-Creationist Controversy." Root-Bernstein, who works at the Salk Institute for Biological Studies, considers the controversy in the light of the philosophy of science. He does this with such clarity of argument that his paper can be enjoyed even by a reader who has never before considered the precepts of scientific thinking, and he comes to this conclusion:

The evolutionist-creationist controversy is not a scientific one. It is a religious, political, and educational controversy stemming from three basic problems: 1) the confusion between science and religion; 2) the attempt by creationists to subject science to ideological control; and 3) the total failure of our educational system to teach the public the basic information needed to evaluate and recognize these problems. In short, the controversy is not caused by scientific disagreements. It is caused by ignorance: ignorance of what science is, what religion is, and how they differ; ignorance of the sociopolitical danger of ideological control of science, ignorance of the purpose of modern education. I assert, therefore, that scientists are wasting their time debating scientific issues with the creationists. Creationism is not the enemy. Ignorance is. Debates are no solution. Education is. And on this score, evolutionists clearly have as much to learn as do creationists—particularly in the fields of history, philosophy, theology, and politics where the educational battle must be fought.

He is right, and his insights should be borne in mind continuously by anyone who seeks to understand creationism. The substantive disagreement between scientists and biblical literalists was resolved more than 100 years ago, when Bible stories could no longer be sustained as explanations of nature. The creationists

thrive by pretending that that resolution never took place, and their pretense is nourished by the kinds of ignorance that Root-Bernstein cites.

But if that's true, why does Root-Bernstein observe that scientists are wasting their time when they debate with creationists? Isn't scientific discourse an agent for dispelling ignorance? Isn't Root-Bernstein contradicting himself?

No, he isn't. He is making a vital point that proceeds inevitably from his analysis. The scientist who disputes with creationists about scientific matters fails to recognize that the creationists are seeking not to explain nature but to control schools. If they were interested in understanding nature, all controversy would have ended long ago. If they were interested in understanding thermodynamics, they would be studying it instead of misrepresenting it. But they have no such interests, and the issue at hand is not what science has learned but what the schools will teach.

This doesn't mean that all discourse is futile or that informed citizens can do nothing to oppose the influence of creationism on public policy. It means that we must go beyond scientific questions to political ones, must be ready to work in a political context, and must understand that a discourse will be worthwhile only if it enlightens a political process. Such a discourse was the Arkansas trial. It turned not on facts about stones and bones but on some of the deeper considerations that Root-Bernstein enumerates: what science is, what religion is, and how they differ. The three publications that I have described here can promote understanding of these distinctions. I hope that they will do some good.

LOOKING BACKWARD

One of the ignoble traditions of textbook publishing in the United States is the corrupting of evolutionary biology, and of biology as a whole, for the sake of placating creationists. That tradition is prominent and virulent today.

THE PHILOSOPHER and educator John Dewey began one of his most trenchant essays with a sanguine observation: "That the publication of the 'Origin of Species' marked an epoch in the development of the natural sciences is well known to the layman."¹

Dewey's confidence in the public's comprehension of Darwin's work and its significance bespoke the exuberant times in which he was writing. The year was 1909. The principle of evolution through natural selection, promulgated some fifty years earlier, had transformed biology from a science of description and enumeration into a science of analysis and explication; books for readers at all levels were reflecting that transformation and were presenting the theory of evolution as the new science's great explanatory engine.

Consider, for example, a fine little work that appeared in that very year: Caroline Stackpole's *Biology*, issued as a part of a ten-volume set that was intended for the general reader and was rather ambitiously called *The Science-History of the Universe*.² Seven of Stackpole's sixteen chapters dealt with the nature, the evidence, and the theory of evolution.

Evolution was making its way into schoolbooks too, and in 1914 the American Book Company issued a high-school text that later would become famous for its discussion of evolution and of Darwin: *A Civic Biology*, by George W. Hunter.³

Hunter's treatment of evolutionary biology was neither extensive nor comprehensible, nor did it make clear the significance of evolution in the biology of his time. But it provided a straightforward definition of *evolution* ("Evolution means change . . ."), it said a bit about "the great Englishman Charles Darwin" and his "wonderful discovery of the doctrine of evolution," and it even spoke about the evolution of man.

A far better exposition appeared in 1921, when Henry Holt and Company issued the textbook *Biology for Beginners*, by Truman J. Moon. As his frontispiece, Moon offered a portrait of Darwin. In his preface, he noted that biology was "a unit science, based on the fundamental idea of evolution." In his text, he distinguished clearly between the fact of evolution and the theory that had been advanced to explain that fact, wrote a coherent account of the theory of evolution through natural selection, showed a diagram depicting the descent of apes and man from a common ancestor, and took pains to point out that "in the minds of the greatest scientists and philosophers there is no conflict between the conclusions of Science and Religion." Finally, near the end of his book, Moon told his reader forthrightly that Darwin's "work along the line of evolution and natural selection revolutionized all modern thought. . . ."⁴

Moon's handling of evolution was accurate, insightful, and decisive. It also was doomed. By the time when *Biology for Beginners* appeared, fundamentalists already had begun their offensive against the teaching of evolutionary biology in the public schools, and their efforts soon were recognized not only by state officials but by authors and publishers of textbooks. Some of the things that happened then are recounted by Judith V. Grabiner and Peter D. Miller in their well-known analysis of the impact of fundamentalism

on biology books:

Among the results of this activity were anti-evolution laws passed in Oklahoma and Florida in 1923. The governor of North Carolina publicly opposed the teaching of evolution in 1924. Perhaps as a response to these events, a number of new textbooks were published in 1924. Many of these treated evolution very cautiously.

For instance, the widely used . . . New Biology (Allyn & Bacon, Boston, 1924) devoted about two pages to evolution and did not discuss the origin of man at all. Arthur Clements's Living Things (Iroquois, Syracuse, 1924, 1925) almost ignored evolution save for a brief mention. Benjamin Gruenberg wrote another text, Biology and Human Life (Ginn, New York, 1925), which paid substantially less attention to evolution than [had Gruenberg's Elementary Biology, issued first in 1919]. And James Peabody and Arthur Hunt, [in] Biology and Human Welfare (Macmillan, New York, 1924), explicitly excluded evolution, citing in their preface a report by the College Entrance Examination Board claiming that a thorough treatment of evolution might be too difficult for high school students. . . . But the presumed "difficulty" of evolution seems to have been more than conceptual. The publication of such books at precisely the time when some legislatures had passed, and others were considering, antievolution laws was no coincidence.⁵

In 1925, John T. Scopes was charged with violating Tennessee's law that proscribed the teaching of evolutionary biology in public schools. His trial brought some fame to the textbook from which he had taught—Hunter's *A Civic Biology*—and produced a genuine revolution in the publishing business. Grabiner and Miller give this description:

The impact of the Scopes trial on high school biology textbooks was enormous. It is easy to identify a text published in the decade following 1925. Merely look up the word "evolution" in the index or the glossary; you

almost certainly will not find it. About its place in the text itself, it is harder to make generalizations.

In 1926, a new edition of [Hunter's book] was published. And it had been changed. . . . [T]he paragraph on "The Doctrine of Evolution" and the evolutionary tree are gone. . . . The word "evolution" no longer appears in the index. Darwin's influence on the study of the "development" of species is no longer stressed; . . . The word "evolution" has disappeared from the paragraph [that in the first edition was called] "Charles Darwin and Natural Selection;" the paragraph is now titled "Natural Selection." The paragraph on "Evolution of Man" has now become "Development of Man."

The year 1926 also saw a new edition of Moon's *Biology for Beginners*. . . . The most striking evidence for the influence of fundamentalist pressures on Moon's book is to be found in the frontispiece. [Charles Darwin] was banished in favor of something less controversial—a cartoon cutaway diagram of the digestive system. The preface in 1921 had stated that biology was "based on the fundamental idea of evolution"; in 1926, this became the "fundamental idea of development." Otherwise, however, Moon's book retained its substantial treatment of evolution, . . . [but] some religious quotations were added to the chapters. . . . [O]nly after the 1926 edition did Moon and his publishers begin to emasculate their treatment of evolution.

When Moon's book was issued anew in 1933, its index was evolution-free.

I have borrowed at length from Grabner and Miller because the events that they describe represent the birth of one of the ignoble traditions of textbook-publishing in the United States: corrupting evolutionary biology, and biology as a whole, for the sake of placating creationists. That tradition is prominent and virulent today. Right now, some publishers are offering biology books or life-science books that don't discuss evolution, don't mention the word *evolution*, and are no more relevant to contemporary science than are, say, the San Francisco telephone directories. Books like that aren't typical, however. Much more common are books that do treat evolution but confine it to one isolated and attenuated

chapter. Everywhere else they strive to avoid mentioning evolution or evolutionary inferences, and they simply conceal the importance of evolutionary thinking in modern biology.

An interesting exercise in this context is to go through a stack of current biology texts and try to find one that conveys, explicitly or implicitly, two points that Moon made so well in 1921: that biology is a coherent science based on the idea of evolution, and that the work of Darwin revolutionized all modern thought—or, at least, modern science. You'll have a jolly time.

This is not to say that all the biology books that discuss evolution do so in the same way, or that all are uniformly poor. Though most books are shamefully defective and deceptive, four or five—no more than that—provide forthright explanations, indicate how the facts of evolution pervade biology, and suggest how the theory of evolution unites it.⁶

If the biology books are disappointing, books for courses in life science—a kind of introductory biology, usually given in a middle-school grade—are simply degenerate. Here too, one can divide books that don't dare to mention evolution from books that do, but that division is an empty exercise: All the ones that acknowledge evolution do so in interchangeable chapters that are so fearful, so equivocal, and so false that they necessarily leave their young readers bewildered and betrayed. (For reviews of seven of these books—ones that recently were submitted for adoption in California—see page 15).

EVEN IN THE YEARS since the Scopes trial, evolution hasn't always been handled in textbooks as it is being handled now. At some times, it has received noticeably better treatment; at other times, it has received noticeably worse. The foremost student of its fortunes is Gerald Skoog, a professor of education at Texas Tech University (Lubbock, Texas). Skoog has analyzed textbooks in considerable detail, and this is a summary of his findings:

Analyses of 102 high school biology textbooks published since 1900 revealed definite

trends in the coverage of evolution. . . . Prior to 1960, the coverage of evolution generally was brief, noncontroversial, and characterized by restraint. There was an increase in emphasis on evolution through the 1930s and 1940s, but a slight de-emphasis occurred in the 1950s. This probably was a result of the conditions that characterized the McCarthy era. In the 1960s, evolution received unprecedented coverage in the textbooks, clearly as a result of the use of evolution as a theme by the Biological Sciences Curriculum Study (BSCS) in the development of three different textbooks that received much acceptance from biology teachers.

During the 1970s, there was a definite decline in the coverage of evolution in biology textbooks. For example, Biology (Smallwood and Green, 1968, 1974, 1977) cut its coverage of evolution in half from 1968 through 1977. The decline was less drastic in other textbooks, but there were many word changes that resulted in statements about evolution that were more cautious and indefinite.

In 1981, Experiences in Biology [a new title issued by Laidlaw Brothers, Publishers] . . . provided evidence of the growing success of the antievolutionists. This biology textbook contained no specific chapter on evolution and the word evolution did not appear in the glossary, index or text of the book. The textbook did contain material on natural selection, human evolution, and other topics concerned with evolution, but it was scattered. . . . Other textbooks published in the early 1980s showed the impact of antievolutionist pressures. Biology (Slesnik et al., 1980), for instance, had no material on human evolution. . . . The popular Modern Biology (Otto, Towle, and Bradley, 1981) reduced its coverage of evolution to its lowest level since 1963. Similarly, Biology (Smallwood and Alexander, 1981) underwent another major revision that resulted in extensive deletions. . . . Moreover, textbooks that appeared for the first time in the 1980s generally had less emphasis on evolution than did textbooks published in the late 1960s and early 1970s.⁷

The matter of word changes that made statements "more cautious and indefinite" was by no means trivial. Here are some of Skoog's examples:

In Modern Biology, at least sixteen illustrations of different time scales [showing evolutionary histories] present in the 1977 edition

were deleted in the 1981 edition. The 1977 edition . . . stated that there was little doubt that snakes [had] descended from reptiles with legs. "They could have" replaced "there is little doubt" in the 1981 edition. *Eohippus*, a fossil horse, was called "the ancestor of the modern horse" in the 1977 edition of *Modern Biology* but simply "the ancient horse" in 1981. . . .

The words "change," "result," or "development" are often substituted for the word "evolution" as textbooks are revised. *Modern Biology* in 1977 stated that genetics "helped us to understand how evolution works." The ending of this sentence was changed to "how changes occur" in 1981. Merrill's 1979 textbook *Biology* stated that "as a result of natural selection, a resistant strain of houseflies evolved." In the 1983 edition, . . . "resulted" was substituted for evolved. In several other statements, the word "came" took the place of "evolved." . . .

This hesitancy to use the word "evolution" and efforts to treat evolution as theory produced some ambiguous and awkward statements. Macmillan's *Biology* indicated that "the theory of evolution may be at least in part the result of changes in the structure of genes, or mutations" and "the study of change through time on the molecular level has two advantages." . . .⁸

Such shenanigans were prominent features of many books that appeared a few years ago. Those books had been conceived during the late 1970s, when the force of creationism was at its peak and when opposition to creationism was weak and poorly organized. While the evolutionless *Experiences in Biology* is the best-known example of that shabby crop, some of the others were comparably emetic. One was *Prentice-Hall Life Science*, a book that so blatantly perverted science and endorsed creationism that New York City's Board of Education cast it out for precisely those reasons (see page 25).

Understanding all this requires understanding some things about the textbook business—most importantly, that it is indeed a business. Books used in elementary and secondary schools are consumer goods, assembled by companies that seek shares of a market that now is worth \$1.4 billion a year. There are some sixty-five such companies, but most of them are small and offer a small list of titles. The business is dominated by about a dozen

large companies that publish in many subjects, for all or most grades, and that collectively provide most of the schoolbooks used in this country.⁹

AS WITH ANY consumer product, a textbook must be sold in quantity if it is to be profitable; and this principle pervades the publishers' efforts in market research, design, and manufacturing. Those efforts, which in typical cases are effected by teams of technicians, bear little resemblance to what the layman would call writing; and the typical product that they yield bears little resemblance to what the layman imagines a textbook to be—that is, a statement of information and interpretations that have been chosen and presented by some identified person or persons. The usual textbook today is an aggregation of stuff that has been pulled together by anonymous writers and then attributed to nominal authors whose names and titles suggest legitimacy. In some cases, one or more of the nominal authors actually have contributed something to the book; in other cases, they haven't.

This approach to publishing was described well in Frances FitzGerald's excellent inquiry into the textbook business, *America Revised*.¹⁰ FitzGerald wrote about the production of American-history texts, but the practices that she depicted are common in all branches of the industry:

Texts are not "written" anymore; they are, as the people in the industry say, "developed," and this process involves large numbers of people and many compromises. . . . Typically, the first step in the current process is to find two or more authorities in the field, including one academic historian and one schoolteacher or administrator. . . . As a rule, the younger the audience the book is intended for, the greater the number of specialists involved. The high-school books usually have two authors' names on the cover; the eighth-grade books usually have three; and the social-studies series running from kindergarten through the sixth grade have a whole raft of them. . . .

Whether a publisher has chosen his authors well or badly, his editors usually have a fairly exact idea of what should go into the book he

has commissioned. In the first place, they have read the texts for college students, and these show what is necessary in the way of scholarly furnishings. In the second place, they have analyzed the competition, so they know what is selling in the school systems. At one publishing company I visited, the social-studies editor was doing a line count of the ten best-selling eighth-grade histories to find out how much space each gave to each major event in American history. . . .

To the uninitiated, the very thought of what goes on in a textbook house must inspire a good deal of vertigo. Way up in some office building sit people—ordinary mortals with red and blue pencils—deciding all the issues of American history, not to mention those of literature and biology. . . . On one hand, they are running what amount to Ministries of Truth for children, and, on the other, they are simply trying to make money in one of the freest of free enterprises in the United States, where companies often go under. The market sets limits to the publishers' truth-giving powers. These limits are invisible to outsiders, and they shift like sandbars over time, but the textbook people have a fairly good sense of where they are likely to run aground—and for the rest they feel their way along.

Most of the books that emerge from the ministries are, for a specified subject and grade, quite interchangeable. They have been developed by similar methods for the same mass markets, and they reflect the tastes and fashions and prejudices that customers in those markets can be expected to support with dollars.

At least as important as deciding what gets into a schoolbook is ensuring that a great array of things are excluded. In accordance with formal guidelines issued by prospective purchasers, and with their own perceptions of what customers will or won't like to find in a new book, publishers sterilize their products with transcendent diligence. One recent account of this process was written for the Berkeley tabloid *East Bay Express* by Alan Rifkin, who had worked as a copy editor for a schoolbook company on the West Coast. Here is a part of his description of the editing of a reading text for sixth-graders:

In deference to fundamentalists, the editors removed the ghost from a ghost story, because

ghosts hinted of reincarnation. They challenged the use of excerpts from Don Quixote on the grounds that the slow-witted Sancho Panza was an "inappropriate source of humor." They deleted a reference to Jonathan Swift as a satirist of the social order, for want of counterbalancing remarks about the order's better points. Swift's excerpt, adapted from Gulliver's Travels, came through relatively unharmed. But Washington Irving's appears to have been politically sanitized: in 1985, Rip Van Winkle does not "lay all the blame on the Dame Van Winkle," nor does the Dame Van Winkle "henpeck" Rip. Nor is she called "Dame."

One story, written in the form of a young girl's diary, made fleeting reference to a formal dinner with an eccentric matron, who forever complained about the help. This stab at characterization stood out like a sore thumb, and was properly removed. The entire passage, as children will see it, now reads: "The cook prepared a really sumptuous dinner. To me, everything seemed wonderful."¹¹

For a broader view, consider an item from the *New York Times* about guidelines that an unnamed publisher sent to a woman who was writing an English-composition text:

The publisher doesn't want mention of "political figures in American history over whom controversy still exists: F.D.R., Nixon and Agnew, for example." The prohibition even extends to the future: no references to "living people who might possibly become infamous."

Authors must "avoid topics that would undermine legitimate authority—the family, the government and its branches, teachers, police and so forth." Lest a breath of skepticism enter the stagnant classroom air, children must also be shielded from "poems and stories written by known or suspected dissidents."

That cuts a broad swath through the world's best literature. But it's not just the political establishment that needs protection from childish skepticism: "Avoid references that put the free enterprise system in a bad light." Also on the index: evolution, magic, fortune-telling, sex, arcades, video games, skateboarding, religious holidays and censored books.¹²

It is hard to imagine another practical context in which evolution would appear on a list with Franklin Roosevelt and "references that put the free enterprise system

in a bad light," but here such a list makes perfect sense. It reflects prejudices that reign in backward states of the South, and the inordinate influence that those states exert on the content of schoolbooks sold throughout the country.

THE MOST important purchasers of textbooks are agencies of the twenty-two "adoption states"—those in which state officials choose the textbooks that will be used in some or all grades of the states' public schools. Together, the adoption states buy nearly half of all the textbooks that are consumed. In terms of sales, the outstanding adoption states are California, Texas and Florida. In terms of influence, Texas predominates for at least two reasons. Texas adopts books for all the grades, from kindergarten through high school, while some other states (including California) adopt for elementary and middle schools only. And Texas limits to five the number of books that it adopts for a given subject and given grade, while some other states (including California) may adopt many more than that; hence a book adopted in Texas has fewer competitors and is more likely to be sold in substantial numbers.

Publishers accord great weight to the preferences of the adoption states, and especially to the preferences of the big ones. As a result, the publishing business acts as an amplifier: By tailoring textbooks to the tastes and requirements of the adoption states and then marketing the books throughout the country, publishers elevate those tastes and requirements into national norms.

This might not be corruptive if the signals fed into the amplifier were highly diverse, and if the amplifier itself were indiscriminate—that is, if it handled all the signals in the same way. But neither of these conditions applies. The signals aren't highly diverse because seventeen of the adoption states are southern states in which fundamentalists and other reactionaries wield considerable power.¹³ The amplifier isn't indiscriminate because it responds more strongly to signals of reprobatation than to signals of approval: Pub-

lishers strive more urgently to exclude subjects that might offend customers than to include subjects that might edify them. They seek what may be called the blandest common denominator, and their books are not merely interchangeable but interchangeably insipid and banal.

That publishers should shape biology books in this way is outrageous, but most of them do it. As Jack L. Carter, a professor of biology at The Colorado College (Colorado Springs, Colorado), recently observed:

[I]f Texas demands that human reproduction be stricken from the tenth-grade biology course, and Rhode Island demands that human reproduction be included in the biology textbooks for that state, Rhode Island will probably have considerable difficulty [in finding] appropriate biology textbooks for their science classrooms. Or if the terms penis and vagina offend some segment of society, publishers simply omit any discussion of human reproduction, teach frog reproduction and discuss the cloaca. Sound business practices require that textbook-publishers produce middle-of-the-road textbooks for middle-of-the-road students in middle-of-the-road school systems.¹³

Carter's choice of Texas for his example was hardly random. For many years, fundamentalists in Texas have exerted great influence over the writing of biology books and thus over the biology taught in schools throughout the country.

In 1974, the Texas Board of Education adopted rules that explicitly required publishers to cripple any discussion of evolution in any of their books. There were several such rules, two of which were especially pernicious:

Textbooks that treat the theory of evolution shall identify it as only one of several explanations of the origins of humankind and avoid limiting young people in their search for meanings of their human existence.

Each textbook must carry a statement on an introductory page that any material on evolution included in the book is clearly presented as theory rather than fact.

And a lot of them did. Publishers of many important texts—eager to sell in the Texas market but unwilling to issue Texas editions—produced books that complied with Texas's rules, then sold those books

nationally. Youngsters in dozens of states received texts that misrepresented the substance and status of evolutionary biology, promoted the confusion of science with religion, affirmed the Texas fundamentalists' misrepresentation of the meaning of *theory*, and parroted their nonsense about "theory rather than fact." Listen to this, from the preface to the 1977 edition of *Modern Biology*, published by Holt, Rinehart and Winston:

In the section of Modern Biology dealing with evolution, scientific data have been used to present this material as theory rather than fact. The information presented allows for the widest possible interpretation that can be applied to any set of values, whether religious or scientific. Every effort has been made to present this material in a nondogmatic manner.

THE ORIGIN of the Texas rules lay in efforts begun in 1973 by a fundamentalist couple named Mel and Norma Gabler. They are diligent and effective ideologues of the religious right, and they enjoy national prominence as leaders of that faction's attempts to control the content of textbooks.

From their home in Longview, Texas, the Gablers run an enterprise called Educational Research Analysts. Much of their research and analysis is aimed at identifying and opposing schoolbooks that seem not to support patriotism, nationalism, capitalism, and fundamentalist Christianity, or that encourage youngsters to analyze moral codes, social institutions, political and economic systems, attitudes toward sexuality, or beliefs in the supernatural. They imagine, as do many religious rightists, that the public schools are preaching a sort of godless religion called "humanism" or "secular humanism,"¹⁴ and that many of the textbooks now in use reflect a liberal ideology in which the purpose of education is social manipulation "rather than the imparting of factual knowledge, basic skills, and cultural heritage."¹⁵

The things that the Gablers have found offensive make a diverse array indeed: the story of Robin Hood, Poe's *The Cask of Amontillado*, a history text's reference to George Washington's violent temper, a

social-studies text's discussion of Marilyn Monroe, questions that required students to offer opinions about the Vietnam war, books that seemed to neglect the "essentials and benefits of free enterprise," books that (by the Gablers' reckoning) gave 5.8 times as much space to the French Revolution as to the American, "evolution taught as fact," and statements that humans appeared on Earth about a million years ago—statements that the Gablers dismissed as "only conjecture from evolutionary dogma."^{14,16}

The Gablers' rejection of evolution along with Robin Hood and Marilyn Monroe is not surprising. For the religious right, evolution is entirely a matter of ideology and belief; science has no bearing on the matter. Nor is it surprising that the Gablers appear not to know what evolution is. Consider some excerpts from their recent review¹⁷ of *Heath Biology*, a textbook published by D. C. Heath and Company:

Evolution postulates quantitative increases in net genetic complexity through mutation. But mutations only change DNA structure. They do not increase net genetic complexity. This text, however, fails to evaluate evolution on the basis of this biological fact. Instead it confuses the non-evolutionary differentiation of new species (which mutation might theoretically produce), with the evolutionary development of new genera, families, and orders (which mutation cannot produce, because mutations cannot increase net genetic complexity). . . . This text's repeated definition of "evolution" as mere biological "change over time" is inaccurate enough to include even such obviously unevolutionary phenomena as cumulative genetic decay (e.g., sickle-cell anemia) and adverse mutagenic effects of environmental hazards. . . . Heath Biology defines "adaptive radiation" as the evolution of "many new species . . . from a single ancestral species"—in short, speciation. Previous comments have shown that use of the term "evolution" in this context is a scientific misnomer, since recombination and mutation involve no net increase of genetic complexity (which real evolution requires), so that we are really speaking here of lateral differentiation (i.e., speciation) rather than of true vertical development.

Vertical development? Lateral differen-

tiation? Cumulative genetic decay? Non-evolutionary differentiation of species?

None of this means anything in science, though fanciers of creation pseudoscience will find it familiar. That the Gablers or any other people who trade in such doubletalk should dictate standards and semantics for education in science is laughable. For about ten years, however, the Gablers and their allies were doing just that.¹⁸

And then, last year, Texas's antievolution rules were thrown out. In March, in an opinion solicited by a state senator, Texas's attorney general, Jim Mattox, declared that the rules had no demonstrable secular purpose and that they could be explained only as responses to political pressure applied by creationists.¹⁹ He continued:

The "meaning of human existence" is not the stuff of science but rather, the province of philosophy and religion. By [injecting] into the rules language which is clearly outside the scope of science, the [Board of Education] has revealed the non-secular purpose of its rules.

Mattox's opinion wasn't binding on the board, for Texas law doesn't require executive agencies to honor such findings. But the opinion considerably strengthened the hand of People For the American Way, an organization that had begun in 1982 a campaign to have the rules rescinded. People For the American Way now threatened to seek an injunction delaying the adoption of new science textbooks—an event that was scheduled to take place later in the year—unless the board repealed the rules outright. The board did so in April,²⁰ though it established at the same time a new rule requiring that theory, of any kind and in any subject, be "clearly presented as theory and in an objective manner."

Texas creationists and the Texas Board of Education have been prominent factors in the corruption of science textbooks, but their importance can be (and sometimes has been) overestimated.

"To lay all this on Texas alone is to be naive," Gerald Skoog said to me during a recent conversation. "Recognize that there was a considerable erosion of the treatment of evolution in textbooks after

the mid-1970s, when books were being prepared for Texas's last adoption [before the one conducted last year]. The publishers who sponsored this erosion did it for reasons other than pleasing Texans."

Quite so. Laidlaw's *Experiences in Biology*, for example—the 1981 book that omitted evolution entirely—wasn't ready in time for the Texas adoption, nor were various other evolutionless texts that appeared in the early 1980s.²¹ Those products had been developed for lesser markets in which, their publishers judged, customers would favor books that subordinated science to superstition.

The prospective impact of the repealing of Texas's antievolution rules can be

overestimated too. Texas no longer requires publishers to disgrace their books with nonsensical disclaimers, but neither does it require that the books say anything at all about evolution. The guidelines that governed the selection of science texts in Texas in 1984 made no mention of evolutionary biology or of Charles Darwin, and publishers who wanted to ignore evolution could do so; indeed, the guidelines seemed to invite them to do so.^{18,22}

The authors and publishers who have been playing to creationists in the writing of textbooks aren't going to turn honest overnight because Texas has abandoned some egregious formulas, nor will all the biology and life-science books offered in

this country suddenly turn competent. Teachers and school districts and states that want honest and competent books will get them only by exploiting the appropriate forces—the forces of commerce. They should remember, I suggest, a comment that was offered to me by William N. Moore, the editor-in-chief for school science and mathematics at Holt, Rinehart and Winston:

"If our customers don't care, why should we fight a battle? The only people whom we care about are our customers, and I don't know of any business that operates in any other way."

1. J. Dewey. 1909. The influence of Darwinism on philosophy. (This piece, published first in *Popular Science Monthly*, has been reprinted in many collections. A recent one is: M. Gardner, editor. 1984. "The Sacred Beetle" and Other Great Essays in Science. Prometheus Books. Buffalo, New York.)

2. C. E. Stackpole. 1909. *The Science-History of the Universe. Volume V: Biology*. The Current Literature Publishing Company. New York. vii + 296 pp.

3. G. W. Hunter. 1914. *A Civic Biology*. American Book Company. New York. 432 pp.

4. T. J. Moon. 1921. *Biology for Beginners*. Henry Holt and Company. New York. x + 558 pp. (A facsimile edition was issued in 1981 by Holt, Rinehart and Winston, Publishers; New York. Moon's book was the progenitor of Holt, Rinehart's current textbook *Modern Biology*.)

5. J. V. Grabiner and P. D. Miller. 1974. Effects of the Scopes trial. *Science* 185:832.

6. I shall not in this article present analyses of individual books, for I haven't space for them. Reviews of eighteen current titles, with emphasis on their treatment of evolutionary biology, appear in: W. A. Moyer and W. V. Mayer. 1985. *A Consumer's Guide to Biology Textbooks, 1985*. People For the American Way. 1424 16th Street, NW (Suite 601), Washington, D.C. 20036

7. G. Skoog. 1983. Equal time for creationism? No. *Texas Tech Journal of Education* 10(2):87.

8. G. Skoog. 1984. Religious conservatives bully textbook publishers. *Business and Society Review* 48:49.

9. B. Davis. 3 January 1985. Many forces shape making and marketing of a new schoolbook. *Wall Street Journal*.

10. F. FitzGerald. 1980. *America Revised*. Vintage Books. New York. 240 pp.

11. A. Rifkin. 1985. If books could kill. *East Bay Express* 7(23):1.

12. Anon. 6 June 1984. Topics: literature lessons. *New York Times*.

13. J. L. Carter. 1985. Who determines textbook content? A biologist's perspective. (Paper presented on 31 May during the symposium "Controversial Issues in Content and Control of High-School Science Textbooks" at the annual meeting of the American Association for the Advancement of Science.)

14. D. Kleiman. 14 July 1981. Influential couple scrutinize books for "anti-Americanism." *New York Times*. (For more information about the religious right's preoccupation with "secular humanism," see the article that begins on page 32.)

15. M. Gabler and N. Gabler. 1983 and 1984. Parents [sic] guide to textbooks [sic] review and reform. *Christians in Education* 1(1):15 and 1(2):12.

16. R. Reinhold. 3 August 1983. Textbook debate broadens in Texas. *New York Times*.

17. The review was submitted in 1984 to the Texas Education Agency.

18. W. A. Moyer. 1985. How Texas rewrote your textbooks. *The Science Teacher* 52(1):22.

19. R. Lewin. 1984. Antievolution rules are unconstitutional. *Science* 223:1373.

20. R. Reyes. 14 April 1984. State board moves to junk evolution rule. *Houston Chronicle*.

21. For example:

J. T. Richardson et al. 1982. *Life Science*. Silver Burdett Company. Morristown, New Jersey. vii + 567 pp.

J. M. Oxenhorn. 1981. *Exploring the Living World*. Globe Book Company. New York. xii + 500 pp.

J. E. McLaren et al. 1981. *Spaceship Earth: Life Science*, revised edition. Houghton Mifflin Company. Boston. ix + 534 pp.

These three still are being marketed in the form in which they were issued. Laidlaw's *Experiences in Biology* has been changed, but to little effect. See page 25.

22. Anon. 23 January 1984. Deep in the heart of ignorance. *New York Times*.

EXPERIENCES IN PUBLISHING

AMONG RECENT CASES in which publishers have corrupted textbooks to please creationists, the most notorious may be that of *Experiences in Biology*. This book was issued as a new title in 1981 by Laidlaw Brothers, Publishers (River Forest, Illinois), a division of Doubleday & Company, Inc.

The central fact of the case is straightforward: In creating *Experiences in Biology*, Laidlaw's writers categorically excluded the subject of evolution, the very word *evolution* and the very name of Darwin. The text that they produced was a travesty, unredeemed by a complement of throwaway lines that hinted at organic change or at shared ancestries but never really affirmed those things or suggested that they might be explicable:

[M]any biologists think that the early forms of green algae gave rise to the development of plants that live on land today. . . . The fossil record seems to indicate that very simple life forms inhabited the earth first. After long periods of time, more-complex [sic] forms appeared. . . . Amphibians are interesting animals to study because they form a link between animals that live in water and those that live on land. . . . Many scientists believe [that the Archaeopteryx fossil found in 1861] is that of a very early, or primitive, bird—a form somewhere between ruling reptiles and present-day birds. . . . [Many biologists] believe that liverworts may have resulted from changes in certain mosses. . . .

And so it went: Many biologists were thinking and many scientists were believing and organisms were developing or appearing or linking or betweening or resulting, but none of this seemed to mean anything. A student could read from cover to cover without learning that biologists had considered organic change to be a rather important subject, had sought to elucidate it, and had developed a coherent theory to explain it.

Laidlaw was not the only publisher that had decided during the late 1970s to court the creationists avidly and to suppress evolutionary biology. Some other companies already had issued new books in which diffident and equivocal discussions of evolution bespoke the same strategy, and a lot of educators had become irritated and alarmed by what they were seeing. When Laidlaw brought forth its book that literally eradicated Darwin and evolution from biology, those educators reacted with anger. Laidlaw had gone too far. *Experiences in Biology* soon became renowned as a symbol of the textbook industry's willingness to subvert science for the sake of sales.

The book achieved true notoriety in June 1982, when the Board of Education of New York City explicitly rejected it because it failed to treat the theory of evolution. The board had approved it more than a year earlier, but then had reassessed it during a survey of the handling of creationism and of evolution in science texts. When the board announced that *Experiences in Biology* had been discarded, Laidlaw's director of publications, Eugene Frank, admitted to the *New York Times* that his company had expunged evolution to placate creationists. His statement, which appeared in an article that the *Times* published on 24 June, suggested an act of charity: "We deleted the term evolution from the textbook because we wanted teachers to be permitted to teach biology without being forced to face controversy from pressure groups."

Even before New York City's action, Laidlaw had become alarmed by proliferating publicity about *Experiences in Biology* and by the book's poor record of sales, and had chosen two countermeasures: The company would produce a pamphlet about evolution to supplement every copy of *Experiences in Biology* that had been sold or would be sold, and it

would issue the book in a new edition that would offer a discussion of evolution.

The pamphlet, twelve pages long, was ready in 1983. It didn't have much effect on the book's fortunes. Herbert Adams, who has been Laidlaw's president since October 1984, has interpreted the pamphlet's failure: "It didn't work. It didn't work because people want a book that does the whole job. What the pamphlet really said was that the book was weak."

The new edition of *Experiences in Biology* was produced in 1984 with a 1985 copyright. It differs little from its predecessor, for nearly all the pages are identical in both versions and carry the same page numbers. The only important difference is that Chapter 25 in the new version comprises eighteen pages about evolution while Chapter 25 in the old was eighteen pages about bioenergetics.

The material about evolution is tenuous, inadequate, and fearful—quite typical of the stuff in books that confine evolution to one chapter at the rear. It tells a little about Lamarck, somewhat more about Darwin, and much more about the publisher's anxiety. It also provides a typical amount of misinformation, including this: "Scientists believe that the archaeopteryx is an ancestor of today's birds."

That's the second explication of *Archaeopteryx*, of course. The older one, in which scientists believe only that *Archaeopteryx* was "a form somewhere between," is still intact in an earlier chapter, and there is not a word to relate the two passages to each other. The same is true for almost all the other throwaway lines of the older text: They are still in place and as coy as ever. The student who reads Chapter 25 may grasp in retrospect that they are hints about evolution, or he may not.

The student who doesn't read Chapter 25 will learn nothing more about evolution than he would have learned by reading the 1981 edition.

Perhaps with these points in mind, Herbert Adams offered this comment: "If the evolution chapter in the new edition is weak, I don't want people to think that this company is going to leave it that way, or that it reflects the current direction in which the company is going."

FAKING IT

Seven new life-science textbooks, submitted for use in California's public schools, capitulate to creationists by mangling and muffling the subject of evolution. Not one teaches the science of the twentieth century.

CALIFORNIA's Board of Education adopts textbooks for use by the public schools in kindergartens and in grades 1 through 8. If a local school district decides to use a book that the state has adopted, the district can use state funds for buying the book in quantity. A district may use books that are not on the Board of Education's lists, but the district may not buy such books with state money unless the board explicitly authorizes the district to do so.

The state's adoption process is organized so that books for each subject taught in the schools are chosen once in every six years. Books for courses in reading and literature were adopted most recently in 1982, for use during the six-school-year period that began in September 1983. Social-science books were adopted most recently in 1983, music books and foreign-language books in 1984, and health and science books in the present year.

During an inquiry into the influence of creationism on science textbooks, I recently analyzed the treatment of evolutionary biology in seven of the books that the department considered adopting for life-science courses.¹ *Life science* denotes a subject that deals with living things but is different from the subject called biology. One difference is that life science has been developed for younger students; it usually is taught in grade 7 or grade 8, while biology is a high school subject, usually

given in grade 10. (Because the board does not adopt books for use in high schools, it does not adopt biology books.) Another difference is that life science pays more attention to topics that involve biological concepts but are outside of formal biology—topics such as overpopulation, personal nutrition, and conservation of soil and water.

My principal criterion for evaluating the presentation of evolutionary biology in the candidate books was this: Evolution is the great theme in the story of life, as science now understands that story; and the theory of evolution is the great explanatory structure that unifies the study of living things. A book about life science, then, should suggest the role of evolution in shaping all the life on Earth, should make clear the importance of evolutionary thinking in contemporary biology, and should indicate how the theory of evolution joins anatomy, physiology, taxonomy, genetics, and other endeavors into a coherent picture of the living world.

None of the seven books in hand does any of those things, and none comes close to doing any of them. None, in fact, presents anything resembling science of the twentieth century. To be sure, each is decked with stuff about genetic engineering or oil spills or clever chimpanzees or artificial hearts or whatever, and a couple even provide programs for life-science computer games. But these are just paint and plaster on an antique structure, for every one of these books presents a biology that biologists abandoned long ago. The viewpoint is that of a sixteenth-century monk or, at best, of an eighteenth-century naturalist: The living world is a static edifice that has some number of discrete parts, and science is the business of enumerating these parts and providing names for them.

This kind of science—this descriptive diversion that has no intellectual core and

no integrative principle—doesn't make sense and can't make sense. As the geneticist Theodosius Dobzhansky declared in an article addressed to science teachers, nothing in biology makes sense except in the light of evolution.²

The writers of these books have worked diligently to shut out that light.

I am not saying that the books don't mention evolution. Every one of them mentions it—mentions it, and rigorously isolates it, in one section about the evidence and theory of organic change. That section usually is presented as one chapter, and usually is placed near the back of the book. Everywhere else, organisms are timeless and changeless things that have no ancestries, no shared histories, no histories at all.

That is a broad generalization, of course, and there are some exceptions to it; but their principal effect is to underscore the perversity that the generalization declares. What's more, most of the exceptions conform to a sort of rule: In surveying the major groups in the plant kingdom and the animal kingdom, life-science books may (but needn't) accord histories to three of them: terrestrial plants as a whole, certain terrestrial plants that flourished in Carboniferous times, and certain reptiles—notably, the dinosaurs. In *Prentice-Hall Life Science*, then, "[B]otanists believe green algae are the forerunners of land plants." In *Heath Life Science*, "Scientists think that at one time—about 300 million years ago—many types of ferns covered the earth." And in Macmillan's *Life Science*, "The dinosaurs lived for over 100 million years. Then, about 65 million years ago, they died out."

All the other groups may as well have sprung up yesterday.

Consider now the strait and isolated chapters in which the writers of these books have sought to discuss evolution itself and the ideas that have been pro-

posed for explaining it. The picture here is thoroughly depressing.

- No book provides a straightforward, competent account of the principles and vocabulary of evolutionary biology. Only two books state and honor a valid definition of *evolution*. Of the five others, some provide no comprehensible definition at all, and the rest use definitions that are patently false. In some cases, the false definitions facilitate a perverse usage in which *evolution* appears only as a part of *theory of evolution*; it never is allowed to stand alone. This is a sop to the creationists, of course, and I shall say more about it later.

- Even in books that use *evolution* by itself, the writing bespeaks a fear of that word, a fearful reluctance to utter it, and a dedication to tactics that will minimize its occurrence, regardless of effects on the style or substance of the material being presented. The most conspicuous tactics are the use of false synonyms (such as *adaptation* or *development* or *mutation* or *natural selection*, none of which means *evolution*) and the writing of circumlocutory drivel that has no meaning because the authors simply refuse to name the subject that they are pretending to discuss.

- No book suggests the connection between evolutionary biology and the classification of organisms, i.e., that classification today is based on evidence of evolution from common ancestors.

- Though the modern view of evolution is built on genetics, no book makes a satisfactory connection between evolution and the principles of heredity. Some writers try but make a muck of things. Some others make a pretense of trying after ensuring that they can't possibly succeed. The reason why they can't succeed is that, in their efforts to placate the creationists, they have deprived themselves of the necessary vocabulary. I'll say more about that, too.

- Most of the books employ to some extent an evasive, equivocal style that vitiates statements about evolutionary biology, and creates demonstrably false impressions, through the reflexive and idiotic use of phrases such as "Many scientists believe" or "Some scientists be-

lieve." In *Heath Life Science*, for example, even the dinosaurs are viewed through this mendacious mist: "Some scientists believe that strange animals with dry scaly skins roamed the earth 225 to 65 million years ago." (Are there, as this seems to suggest, other scientists who *don't* believe that? I am unaware of any, and the writers of *Heath Life Science* say no more.)

- Though all seven books mention one or more theories of evolution, only two or three suggest the existence of a modern theory that is important or interesting to biologists today. The more typical approach is to present evolutionary theory as something out of history—something that was contemplated in the past by Lamarck, Darwin, Wallace and DeVries (or at least some of those four) but hasn't commanded much attention since then.

None of these books is substantially different from, or substantially better than, any other. Here and there, one can find small differences—as I've said, two of them tell what *evolution* really means—but such differences provide little consolation. None of the books is competent.

All this is the more troubling because many teachers will derive their entire comprehension and presentation of life science from one or another of these odd anachronisms. This will be so because many of the teachers who give science courses have had no special training in science or in the teaching of science. Such teachers typically, even necessarily, teach by the book. The ones who teach by *these* books will be depicting life in a way that is largely inane and depicting science in a way that is largely false.

THE REASON why these books are stuck in the eighteenth century is that they have been written for an audience that is stuck there too: the creationists. I don't mean by this that the commercial objective of their publishers was to make sales to creationist customers; I mean that the editorial objective of their writers was to say something about science while accommodating the obsessions of creationist critics and the prescriptions of education agencies that

have embraced creationist semantics. All these books can be read in two ways: as depictions of some aspects of biology; and as statements about the creationists' power to corrupt such depictions.

There is nothing new in this, of course: Authors in the United States have been writing textbooks in this way for decades. And I must acknowledge that each of the books in hand is less corrupt than some of the ones that were issued five or six years ago, and less corrupt than some of the ones that are being marketed now but weren't submitted for adoption in California. But the corruption is obvious nonetheless, and especially so in the perversion of words—the misrepresentation and misuse of terms in ways that implicitly deny evolution or endorse creationist falsehoods. The most important terms in this context are *evolution*, *natural selection*, *theory of evolution*, and *theory* itself; evaluation of the treatment of evolution in contemporary books demands attention to what these words mean in contemporary biology:

- *Evolution* can be defined as a change, over time, in the heritable features shown by a population of organisms. That evolution is occurring now is a fact: Evolution has been observed directly in captive and natural populations. (Classic examples of evolution observed in nature include the emergence of several distinctive North American races of the house sparrow during the 135 years since that species was introduced to North America from England; the emergence of pesticide resistance in many insect populations, which collectively represent many different species; and the emergence of dark-colored populations of the peppered moth in parts of England where the trees on which the moths hide were being darkened by industrial soot.) That evolution has occurred in the past and has shaped all the species that now exist is an inference supported by all the biology and paleontology that we know, and contradicted by none of it.

- *Natural selection* is one of the processes that drive evolution—that is, that cause the features of a population to change over time. The essence of the

process is the propagation of some of the heritable variations that arise by chance in every new generation that a population produces, and the suppression of others. If an individual carries a variation that is especially appropriate to the environment in which the population dwells, the individual leaves an especially large number of descendants. If, on the other hand, an individual carries a variation that is especially inappropriate, that individual leaves an especially small number—perhaps none at all. In this way, appropriate variations become more common in the population while inappropriate ones become rare and may even disappear. Among the factors that produce evolution, natural selection doubtless is the most renowned one—the one that Darwin and Wallace proposed some 125 years ago for explaining evolution, and the one that Darwin elaborated in his book *On the Origin of Species by Means of Natural Selection*. Though Darwin's construct has been expanded and deepened immensely since then, natural selection still holds primary importance in the theory of evolution.

● *Theory of evolution* denotes the body of ideas that explain how and why evolution occurs. This definition reflects the meaning of *theory* in the lexicon of science: a structure of ideas, supported by preponderant evidence, that explain some aspect of nature. No matter what a layman may imagine, *theory* isn't a synonym for *guess*; and no matter what a textbook-writer may pretend, *theory of evolution* isn't a synonym for *evolution* itself. These are vital points because creationists relentlessly misrepresent the meaning of *theory*, obfuscate the difference between the fact of evolution and the theory of evolution, and disparage evolution as something that is "only a theory." When textbook-writers endorse and propagate such nonsense, or fail to contravene it, those actions speak loud.

With these points in mind, I now review the writing about evolution in each of the seven books in hand. I pay special attention to definitions given in each book's glossary, because those definitions usually tell reliably about the ways in which authors have used or misused

words in composing their texts. But here too there are exceptions; as I'll point out, some authors contradict their own glossaries when the semantic seas become rough.

Addison-Wesley Life Science. 1984. B. B. Barr and M. B. Leyden. Addison-Wesley Publishing Company. Menlo Park, California. 526 pp. (For the evidence and theory of organic change: about 32 pages, beginning on 184.)

Glossary items include:

evolution "The idea that organisms have changed gradually over a long period of time."

natural selection, evolution by "A theory by Darwin concerning the way helpful variations spread through a population. According to the theory, variations develop by chance. Individuals with helpful variations are more likely to reach the age at which they can produce young. The variations are inherited by the young."

theory "A way of explaining how or why something happened, on the basis of existing evidence."

Barr and Leyden's treatment of evolution is unusual because it is relatively long and it occurs early.³ In all other respects, however, their text is typical—timorous, confusing, and shot through with error and ambiguity. The fact of evolution is not mentioned, the word *evolution* occurs only in *theory of evolution*, and various things that are known to occur in nature are described as if they occur only in the writings of Darwin:

Darwin's idea is called the theory of evolution by natural selection. According to this theory, variations happen by chance in all populations. They can be passed on to the next generation. . . . According to Darwin's theory, modern populations are still changing. . . .

These writers present, as do most others, accounts of observed evolution in the peppered moth and in insect populations exposed to insecticides. But they describe these strictly as examples of natural selection—*evolution* is not used in these passages—and they thus confuse a process with its product. A youngster who reads

this material must conclude that the term denoting a change in features over time is *natural selection*.

Later in the book, in their exposition of genetics, Barr and Leyden offer a passage that pretends to link natural selection with mutations. It is ridiculous, and it is worth some special attention because it exemplifies passages in several of the books in hand.

The ideas that the authors confront here are straightforward. Natural selection and mutation are quite different things, but there certainly are relations between them. The most important relation arises in the context of evolution, and it can be summarized thus: One of the ways in which natural selection produces evolution is by propagating or suppressing mutations. Textbook-writers should be able to explain that easily, but Barr and Leyden certainly can't. The reason why they fail is that they decide not to mention evolution. That decision abolishes the relation that they must try to depict, transforms a simple problem into a hopeless one, and transforms science writing into an exercise in word-tricks and obfuscation. They conclude with a sentence that is truly tantalizing: "Under some conditions," they say, "mutations may cause a change in an entire population of living things." Biologists have a name for such a change, but these authors won't write it down.

Heath Life Science. 1984. L. M. Bierer and V. F. Lien. D. C. Heath and Company. Lexington, Massachusetts. 536 pp. (For the evidence and theory of organic change: about 14 pages, beginning on 398.)

The glossary omits *natural selection* but offers:

evolution "the gradual development, or change, in species of organisms over time"

hypothesis "a guess based on observations"

theory "the statement of a hypothesis that seems to explain observations and has evidence to support it"

theory of natural selection "the belief that the animals and plants best

adapted to their surroundings survive to produce offspring"

Listen: "Many scientists think that dinosaurs were the ancestors of reptiles." If you enjoy absurdities of that sort, you may find this book diverting.

These authors have done well by declaring and honoring an acceptable definition of evolution, and by making clear the difference between evolution itself and a theory to explain it. Otherwise, their discussion is conventionally poor: short, attenuated, historical, and inconclusive. Lamarck and Darwin and Wallace and De Vries are paraded by, and the chapter ends with a throwaway line followed by a non-sense: "Scientists today continue to explore reasons for the variety of life on Earth. Mutations provide evidence that supports the theory of natural selection." And that's that.

Holt Life Science. 1986. W. L. Ramsey et al. Holt, Rinehart and Winston, Publishers. New York. 564 pp. (For the evidence and theory of organic change: about 15 pages, beginning on 464.)

Glossary items include:

evolution "The process by which organisms change and become different from generation to generation."

hypothesis "A statement that explains a group of related observations."

natural selection "The process by which only the organisms that are best suited to their environment survive. As a result, they pass their traits to their offspring."

theory "A general statement based on hypotheses that have been tested many times."

This book deserves some praise because, in surveying the kingdoms, it makes two exceptions to the rule by which histories may be accorded only to certain plants and reptiles. The writers here suggest histories for the amphibians (in a passage that envisions their arising from freshwater fishes) and for the mammals (in a paragraph telling that the oldest known mammals were contemporaneous with the dinosaurs, and that mammals "developed" rapidly after the Age of Reptiles ended).

Their treatment of evolution itself, however, is disappointing. When I found competent definitions in the glossary, I hoped that the text too might be competent. It isn't; it is inane and remarkably shallow. The writers have been unusually diligent in reducing evolutionary biology to a historical curiosity, in filling space with paragraphs about Darwin's life, and in misspelling *Galápagos*. They don't suggest that Darwin's work was in any way important to modern biology.

The only truly engaging feature of this text is the strikingly crude way in which the authors invoke *theory* to gainsay their glossary definition of *evolution* and to confuse their readers. On page 471, the text says that evolution is a theory, while a note in the margin on the same page repeats the glossary's statement that evolution is a process. The apparent contradiction is not explained or even acknowledged.

Life Science. 1986. P. G. Jantzen and J. L. Michel. Macmillan Publishing Company. New York. 580 pp. (For the evidence and theory of organic change: about 22 pages, beginning on 424.)

Glossary items include:

evolution "The theory of gradual change in species over time."

natural selection theory "The organisms best suited to their environment will most likely survive."

theory "A set of ideas that explains related observations."

This book's section about evolution is exceptionally poor although its scope and attack aren't exceptional at all: Evolution is an "idea." The important thing to know about this idea is that certain people pondered it a long time ago. And now let's talk about something else, shall we?

What distinguishes Jantzen and Michel's book from the others is their style of writing: They are so wonderfully evasive and incoherent that they achieve true opacity. One of their accomplishments is their managing to recite the story of the peppered moth while shunning not only *evolution* but *natural selection* as well. For them, the story is entirely about an *adaptation* and (later) a *mutation*, and it makes no sense whatever.

Focus on Life Science. 1984. C. H. Heimler. Charles E. Merrill Publishing Co. Columbus, Ohio. 536 pp. (for the evidence and theory of organic change: about 16 pages, beginning on 404.)

The glossary omits *evolution* but offers: **natural selection** "survival of the fittest; the most fit organisms are those best adapted to their environment"

theory "an idea that explains things or events"

theory of evolution "the belief that new species come from older species"

Heimler's treatment of evolution is thoroughly fatuous. One example of his approach will suffice:

As some other writers are, Heimler is preoccupied with affirming that evolution exists only in a theory; and, as some other writers do, he refuses to use *evolution* unless it is a part of *theory of evolution*. But his intent exceeds his skill, and finally—when he tries to suggest a connection between mutation and natural selection—he finds himself sinking in his own semantics. Desperate, he abandons science and his glossary, and he declares that a theory isn't something that explains but something that itself needs explaining: "The theory of evolution can be explained by mutations and natural selection."

The suggestion that youngsters should be subjected to this perversity strikes me as cynical.

Prentice-Hall Life Science, 3rd edition. 1986. Anonymous.⁴ Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 512 pp. (For the evidence and theory of organic change: about 30 pages, beginning on 409.)

Glossary items include:

evolution "a gradual change in organisms over a long period of time"

natural selection "Darwin's theory that states that those organisms that are better adapted to their environment survive, reproduce, and pass their traits to their offspring"

theory "an explanatory idea that is based on results of experiments"

Prentice-Hall Life Science provides the broadest discussion of evolution to be found in the seven books considered here.

Its virtues include adherence to a respectable definition of *evolution*, nominal attempts to explain convergence and divergence, and explications of the words *microevolution* and *macroevolution*.

The tone of the writing, on the other hand, is deplorable: anxious, craven, and false. The writers have been especially ardent in using "Many scientists believe" and similar pseudoattributions that can only mislead the reader. Even the proposition that living things have changed over the years is, in this text, just something that "Many scientists also believe."

The real problem with this book, however, is that it isn't fit for use in any natural-science course. Let me explain that judgment and tell an interesting story too:

We have here the third edition of a title that has a notably ignominious history of appeasing creationists. In their first edition, issued in 1980, the authors treated the origin of life and the principles of evolutionary biology in chapters that plainly reflected and endorsed the creationists' "two-model" notions. When they addressed the origin of life they depicted myths, legends, and scientific theories as comparable alternatives, and they declared that the notion of creation by an all-powerful being was a "theory." When they made a pretense of discussing evolution, they relentlessly offered scientific theory and religious belief as equivalents, reduced scientific inference to a matter of what "some people believe," described substantiated findings as unconfirmed possibilities, and concluded by telling how "some people believe" that organisms had been created and hadn't evolved at all.

These antics became salient news in 1982, when New York City's Board of Education rejected the book and sent to Prentice-Hall a letter that explained that action.⁵ The letter cited several passages—all in the text about evolution—that endorsed creationism or misrepresented science, and it concluded:

... there seems to be a direct attempt to put doubt into the reader's mind concerning the meaning of theories and the need of scientific evidence for theories. . . .⁶

For whatever reason, the letter did not

point out comparable passages in the book's discussion of the origin of life.

In the second edition, issued in 1984, the material about evolution was heavily revised but the section about the origin of life was absolutely unchanged.

It now persists unchanged in the third edition,⁷ and it is intolerable. In no other book have I found a passage comparable to this one, which appears on page 309:

The interest in how life began is not new. It is something that people have always wondered about. There are many theories, or ideas, as to how life began on the earth. The Greek myths and some American Indian legends discuss the possibility that life may have been created by a council of gods. Another theory believed by many people involves the presence of one all-powerful being that created the life forms on the earth. And still another theory states that life on the earth came from another planet in outer space.

The purpose of this stuff is obvious from the moment when the writers, by falsely suggesting that "theories" are just any "ideas" about anything, contradict their own glossary. The glossary defines *theory* as "an explanatory idea that is based on the results of experiments," but here *theory* is applied to Greek myths, to Indian legends and quite explicitly to a notion held by some unnamed group (presumably not Greeks or Indians) who contemplate an all-powerful being.

To certify the confusion between a theory and an unsupported belief, the authors suggest to the reader (on page 311) an exercise called "Taking a Poll":

Many scientists and others have offered theories about how life began on the earth. But no one really knows how life began. Why not find out what most people's theories are? You can do this by taking a poll. Interview ten people.

Ask your subjects how they believe life began and what their reasons are for this belief. Compare your results with the results of your classmates. Which theory about how life began on earth did most people believe in? What were their reasons for believing in this theory?

That's it. There's not one word to warn the reader that the results of such a poll will have no scientific significance at all, or to warn that public-opinion polls about scientific questions are favorite affecta-

tions of pseudoscientists. Nor are these points made in the note about "Taking a Poll" in the teacher's edition of the book.

One of the principal goals of contemporary science education is to make youngsters familiar with science's premises and objectives, and to enable them to distinguish science from things that aren't science. This book strives avidly to counteract such efforts, and it has no place in a science classroom.

Scott, Foresman Life Science. 1986. L. Balzer et al. Scott, Foresman and Company. Glenview, Illinois. 498 pp. (For the evidence and theory of organic change; about 10 pages, beginning on 390.)

Glossary items include:

evolution "the theory that states [that] groups of organisms change over long periods of time"

natural selection "process expressed by Charles Darwin that says that organisms best adapted to their environment tend to survive"

theory "explanation that best explains a problem"

As the glossary suggests by its false definition of *evolution* and its ludicrous definition of *natural selection*, Balzer and his colleagues are serving up the usual obfuscatory nonsense: Ain't nobody in here but us theories.

These authors use *evolution* only twice in their text, and in both cases it is a part of *theory of evolution*. The confusion between fact and theory is reinforced by a false statement that explicitly equates the two: "Scientists call such changes in groups of organisms over time the theory of evolution." The rest of the discussion is commensurate.

TO ME, every one of these books testifies candidly to the power of creationists over science education in this country. That writers and publishers should have to produce books like these if they want to command national markets is a national tragedy. For California to choose its life-science texts from among such books would be a travesty. For California to be unable to imagine an alternative would be a disgrace.

1. Publishers submitted nine books as candidates this year. One of them—*Foundations: Life Science*, offered by Coronado Publishers (San Diego, California)—was withdrawn after its publisher decided to discontinue it. I excluded from my analysis one of the eight that remained, because it is a highly attenuated, highly simplified book for students who can't read well. It is called *Concepts and Challenges in Life Science*, and it is published by Cebco, a division of Allyn and Bacon, Inc. (Newton, Massachusetts).

2. T. Dobzhansky: 1973. Nothing in biology makes sense except in the light of evolution. *Ameri-*

can Biology Teacher 35(3):125. (In his text, Dobzhansky expanded his aphorism thus: *Seen in the light of evolution, biology is, perhaps, intellectually the most satisfying and inspiring science. Without that light it becomes a pile of sundry facts—some of them interesting or curious but making no meaningful picture as a whole.*)

3. I deliberately write as if I believe that all the books that I am considering were written by their nominal authors.

4. The title page lists four authors but then states explicitly that only two of them wrote the book. I will not try to sort that out.

5. G. I. Macroff: 24 June 1982. City schools bar 3 textbooks as inadequate on Darwinism. *New York Times*.

6. Letter of 17 June 1982 to Prentice-Hall from Charlotte Frank, executive director, Division of Curriculum and Instruction.

7. Of the books under consideration, only three seem to mention scientific thinking about the beginnings of life on Earth. They are *Heath Life Science*, *Focus on Life Science* and *Prentice-Hall Life Science*.

BOLD ASPIRATIONS

Creationism is a part of a broader political movement that has some notable goals: turning the United States into a theocracy, turning the public schools into agents of religious conformity, and abolishing natural science.

THE READERS of *Pacific Discovery* would affirm unanimously, I suspect, the proposition that public education is a meritorious endeavor. That view is not universal in the United States, however, and a lot of people would dispute it. One such person is the Baptist preacher Jerry Falwell, who has summarized his thoughts about public education thus:

*I hope I live to see the day when, as in the early days of our country, we won't have any public schools. The churches will have taken them over again and Christians will be running them. What a happy day that will be!*¹

Falwell's aspirations are worth noting, for he is not an obscure pamphleteer but a prominent and versatile leader of the political faction known as the religious right. From a headquarters in Lynchburg, Virginia, he runs a number of organizations (among them the Moral Majority) that promote that faction's program, which is founded on fundamentalism, theocracy, anti-intellectualism, and a xenophobic variety of patriotism.

Creationism—the political movement that is striving to further the teaching of biblical creation myths in the public schools and to abolish the teaching of natural science—is only a small part of this program and only a small part of the religious right's current effort to subvert education. By various methods, and most noticeably by trying to control local choices of schoolbooks and curricula, the

rightists are seeking to inject their religion and their ideology into public instruction in nearly all spheres: history, social studies, language, literature, and even mathematics. Their influence is a serious issue in education today, and understanding that issue requires some knowledge of their visions and goals.

The linchpin of the religious right is fundamentalism, a kind of Protestant Christianity that originated in the United States around the beginning of this century. The fundamentalists insist that the Bible must be taken literally as an account of history, and they emphasize belief in the literal truth of stories and predictions about Jesus.

The religious right is fundamentalism's political arm. It draws its members from a number of sects (notably the Southern Baptists, the Seventh Day Adventists, and Jehovah's Witnesses) and it seeks objectives that are depicted in fundamentalist literature as being derived from, or consonant with, biblical prescriptions and prophecies. Statements of these objectives vary considerably, but the principal goals are constant and prominent: a fundamentalist theocracy—that is, a government operated according to fundamentalist readings of the Bible; an economy of capitalism, more or less unrestrained; a foreign policy based on nationalism and chauvinism reinforced by militarism; a social organization in which women would be subordinate to men and would focus their lives on reproduction; a system of education that would discourage analytical thinking in all realms except the purely technical ones; a system of science that would serve only to support commerce and to generate sophistic demonstrations that facts of nature confirm biblical narratives; and theocratic suppression of cultural, intellectual, ethical, or sexual departures from the prescriptions of biblical authorities.

The whole vision can be approximated by recalling the Massachusetts Bay colony in the 1640s and imagining that the colonists had electronics laboratories and nuclear weapons.

The most conspicuous ideologues of the religious right include Jerry Falwell, the lawyer Phyllis Schlafly, and the preachers Jimmy Swaggart, Jim Bakker, James Kennedy, Pat Robertson, and Tim LaHaye. Schlafly runs an organization called the Eagle Forum (Alton, Illinois). Swaggart, Bakker, Kennedy, and Robertson are known chiefly as the proprietors of fundamentalist television shows. LaHaye is a broadcaster, a prolific writer of books that relate fundamentalism to politics, and the leader of the American Coalition for Traditional Values (Washington, D.C.), a group that does lobbying and electioneering. He has said that his coalition delivered 2 million newly registered fundamentalist voters to the Reagan-Bush ticket in the election of 1984.²

The rightists' agenda for education is reflected in efforts to promote textbooks, library materials, and classroom activities that support capitalism, "traditional American" values and a simple-minded brand of Christianity, and in attacks on books and activities that encourage analysis of moral codes, social institutions, political and economic systems, religious practices, attitudes toward sexuality, or beliefs in the supernatural. During the past few years, these attacks have been directed against targets that include a film of Shakespeare's *Romeo and Juliet*, a film that speculated about the aftermath of a nuclear war, exercises intended to promote critical thinking by elementary-school pupils, sex-education courses, textbooks in various subjects, dictionaries that define words that fundamentalists don't like, novels that contradict the fundamentalists' prescriptions about sexuality, and novels or plays that have social

or political themes—works such as Orwell's *Animal Farm*, Steinbeck's *The Grapes of Wrath*, William Golding's *Lord of the Flies*, Harper Lee's *To Kill a Mockingbird*, Arthur Miller's *The Crucible*, and classics by Poe and Stevenson.³

A representative list of the subjects and activities that the religious right doesn't want to see in the public schools was compiled in 1985 by the Eagle Forum and embodied in a form letter that parents could sign and send to local school boards. The letter asserted that federal legislation adopted in 1978 (the Hatch Amendment to the General Education Provisions Act) had provided to parents "the right to assure that their children's beliefs and moral values are not undermined by the schools," and it continued:

Accordingly, I hereby request that my child be involved in NO school activities or materials listed below unless I have first reviewed all the relevant materials and have given my written consent for their use: . . .

Values clarification; use of moral dilemmas; discussion of religious or moral standards; role-playing or open-ended discussions of situations involving moral issues; and survival games including life/death decision exercises;

Death education, including abortion, euthanasia, suicide, use of violence, and discussions of death and dying;

Curricula pertaining to alcohol and drugs; Instruction in nuclear war, nuclear policy, and nuclear classroom games;

Anti-nationalistic, one-world government, or globalism curricula; . . .

Education in human sexuality, including premarital sex, extramarital sex, contraception, abortion, homosexuality, group sex and marriages, prostitution, incest, masturbation, bestiality, divorce, population control, and roles of males and females; sex behavior and attitudes of student and family; . . .

Discussions of witchcraft, occultism, the supernatural, and Eastern mysticism; . . .

Autobiography assignments; log books, diaries and personal journals; . . .⁴

The Eagle Forum's list also showed "Organic evolution, including the idea that man has developed from previous or lower types of living things." That was hardly surprising: Fundamentalists always have denied evolution because it

doesn't fit with a literal reading of biblical creation myths. But the roots of their hostility, today at least, are more complex than that statement may imply. For one thing, they believe that Jesus himself and the writers of the gospels—the four canonized stories of Jesus's life—endorsed the literal truth of the biblical narrative of creation; to suggest that that narrative isn't true, they say, is to suggest that those people were mistaken about history and may have been mistaken about other matters too.⁵ For another thing, fundamentalist writers have erected a sociopolitical theory showing that something called "evolution" accounts for nearly everything that is wrong in the world.

To be sure, what fundamentalists mean by *evolution* isn't quite what biologists mean. For fundamentalist writers, *evolution* denotes all the scientific information and inferences—in whatever field—that contravene biblical tradition. They depict this evolution as powerful stuff, and they write extravagant accounts of its workings and results. Here are three by Henry M. Morris, the president of the Institute for Creation Research (San Diego, California):

Fascism is generally held to be a right-wing movement and Communism a left-wing. Both, however, are variants of the same species, evolutionistic, totalitarian collectivism. In any case, it is clear that the basic rationale of Communism, just as that of Fascism, is the dogma of materialistic evolution. . . .

The sad testimony of multitudes of broken homes and broken lives, in contrast with the joyful testimony of multitudes of truly Christian families, is testimony enough that evolutionary theory and the sexual revolution which has been based on it, is false and deadly. . . .

Furthermore, during the past 150 years especially, the very exploitation of nature—its flora and fauna, its resources, and even its human populations—against which environmentalists are protesting, has itself been carried out in the name of science and evolutionary philosophy. . . . It is significant that all of these environmental problems developed almost entirely within a period when the scientific and industrial establishments were totally committed to an evolutionary philosophy!⁶

In similarly dubious declarations,

other creationist writers have attributed to evolution such diverse products as pornography, pacifism, the legalization of prostitution, and the social advancement of women.⁷

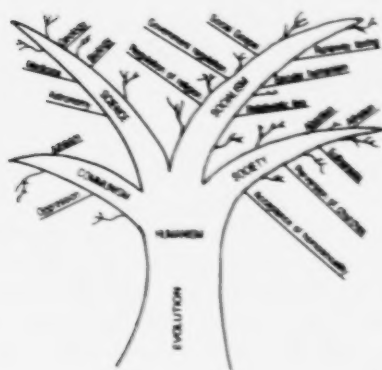
Some observers of the creationist literature have suggested that there is less here than meets the eye—that the purveyors of this nonsense don't believe it themselves but are merely striving to blacken the name of science in every way that they can imagine.⁸ That may be true in some cases, but I doubt that it is universal. There is a simple logic here that, I think, must appeal to simple people: The world is full of things that contravene the divine will; all those things must arise from one source, and that source must be the science that contravenes the divine word.

That there may be no limit to the pile of stuff that creationists will lay at evolution's door is suggested by the diagram reproduced below. It accompanied an article written in 1983 by Paul A. Bartz, the executive editor of *Bible-Science Newsletter*. Lest any reader miss the diagram's message, Bartz summarized it in his text: "Evolution is the taproot [sic] which is feeding the oppressive, murderous, and infidel directions we see gaining acceptance around us."⁹

What evolution is feeding first here is "humanism," and that is to be expected. Fundamentalists relentlessly inject *humanism* into their writing these days, though they give it no consistent meaning. Sometimes they use it for denoting, quite specifically, the philosophy expressed in the Humanist Manifestoes;¹⁰ sometimes they make it a synonym for "secular humanism," an imaginary, godless religion that, they believe, is being preached in the public schools; and sometimes they employ it as a broad label for all that threatens or confuses them, incites their anger or fear, or impedes their return to Massachusetts Bay.¹¹

Bartz has interpreted for me, during a telephone conversation, some of the labels on his tree of infamy. *Evolution* meant "the concept that natural events could have produced things like the origin of the earth, the origin of life, and the diversity of life." *Humanism* meant "anything that

places human values where god values should be." *Relativistic law* meant court decisions based on precedents rather than on the letter of legislation. ("The problem here," Bartz explained, "is that it reflects where society is at a particular time, instead of some objective standard.") *Social gospel* meant "believing that you're bringing about the gospel by helping people to buy homes, or educating them, or getting jobs for them."



I suggested to Bartz that he had attributed to evolution some effects that rather certainly existed before there was any coherent explanation of organic change. Surely, I said, governments were regulating and judges were citing precedents long before anyone thought of natural selection. Could he reconcile those observations with the implications of his diagram?

No, he couldn't, though he tried for several minutes. His principal point seemed to be that evolution was an old idea, detectable in the writings of Lucretius and some other classical authors, and that it had been working its nefarious effects for many centuries before the advent of modern science.

ANTIC NOTIONS about history are common in the fundamentalists' fantasies, as are bizarre historical statements. Here is one from the manual of the National Association of Christian Educators (Costa Mesa, California): "Humanism is the philoso-

phy of fallen human nature . . . a spiritual force reaching back into the ages before creation. In America it was founded in the 1830's."¹²

This statement can be dismissed with a laugh, but the NACE itself must be taken more seriously: Its principal purpose is to help fundamentalist teachers to propagate fundamentalist beliefs, morality and aspirations in the public schools, and it is affiliated with a similar organization for fundamentalist parents, Citizens for Excellence in Education. Both groups are led by a zealot named Robert L. Simonds. Simonds does not equivocate about the objectives of the NACE or about his own disdain for the idea that church and state should be independent:

Government and true Christianity are inseparable! . . . The separation of church and state is another "myth" the [American Civil Liberties Union, the National Education Association, and the National Organization for Women] have sold the public. Secular humanism is a self-pronounced one-world religion. It has complete control of public education. They are the church state, right now.¹²

The manual that Simonds has assembled for members of the NACE is interesting chiefly as a statement of the religious rightists' fear of public education and their intent to subvert it. His explication of tactics for teachers—"How Teachers Can Witness in the Classroom"—is short and vague: The principal recommendations are that teachers should quote religious scriptures, should provide "historical proof and current confirmations of the Christian viewpoint," and should make assignments that require youngsters to read both the Bible and the journal *The Humanist*.

More engaging, if only for its display of ignorance and cynicism, is Simonds's corresponding explication for students: These should "witness" by challenging teachers who present evolutionary biology. To equip the youngsters for these engagements, he provides ten blunt questions that, he seems to believe, will reduce any biology teacher to shivers; he also gives the creationists' answer to each question. This material is attributed to Richard Bliss of the Institute for Creation

Research, and it reflects the customary falsehoods, sophisms, and irrelevancies of creation pseudoscience: The selective breeding of farm animals doesn't have anything to do with evolution but instead confirms the "uniqueness of the genetic system"; there are no transitional forms in the fossil record; a gene can't "break away from the cell regulatory context" to produce something truly new; anthropologists have changed their interpretations of fossil hominids; "evolution theory" isn't useful in searching for petroleum deposits; Bible stories anticipate "the whole idea of tsonils and so forth."

And so forth indeed. As Simonds must know, this silly stuff is already passé. Creation pseudoscience is being discredited well and publicly, and its value to the creationists is dwindling. It will persist indefinitely, I suppose, for the tactical purposes that Simonds is suggesting—duping children and certifying the beliefs of the intransigently credulous—but it will not again have an important strategic role. The creationists' strategies during the coming decade will be identical to the strategies of the whole religious right: trying to gain more influence locally over the affairs of schools and school districts, trying to introduce more fundamentalism into public-school classrooms through the exertions of individual teachers, and trying to exclude unwelcome ideas from school curricula by invoking novel theories of constitutional rights.

Articles that adumbrate or explicate this last strategy have become prominent in creationist periodicals. One that appeared in 1984 in *Bible-Science Newsletter* was written by Kelly L. Segraves, the director of the Creation-Science Research Center (San Diego), but it said nothing about science or creation pseudoscience. Segraves's theme was this: Public schools that "teach the absence of God, either by teaching explicitly against God or by eliminating all references to God" are violating the rights and beliefs of "Christians."¹³

A more recent piece in the same publication reported that the Iowa creationist Harry Bert Wagoner had begun an effort "to get the Senate and Congress to pass a

bill which would give protection to the beliefs of creationists."¹⁴ Such an act, it said, "would give creationist children in public schools a legal protection for their religious beliefs and protection from having those beliefs undermined." Here too, what is significant is the straightforward reference to "religious beliefs" and the absence of pretensions to science.

Even the arborist Bartz is in this game. In a specious essay published in 1984, he found that "common practice in our society forbids public outbursts designed to malign another belief system," and that

the right to analyze "competing beliefs" can be exercised in private but not in "public forums, especially the media and public press, public education and other tax-supported activities."¹⁵

Creation pseudoscience, then, is being replaced by creation pseudolaw; and creation pseudolaw will articulate a constitutional freedom from contradiction. Freedom from contradiction is what the creationists and the rest of the religious right want most of all—freedom to smite down whoever calls ignorance and superstition what they are, freedom to turn

public institutions to the affirmation of private beliefs, and freedom to scotch forever the subversive activities of "humanists"—activities such as questioning and looking and thinking. Tim LaHaye has said it in this way:

*America is a free country, as you know; therefore humanists should be permitted to live and work here. But America must resolve that humanists are unfit to make our laws, serve as our government leaders, teach our young, determine the moral standards of our literature and TV entertainment, or interpret our news. . . .*¹⁶

1. J. Falwell. 1979. *America Can Be Saved*. Sword of the Lord Publishers. Murfreesboro, Tennessee. 162 pp.

2. A. T. Podesta. 5 December 1984. Judge candidates on records, not religions. *Los Angeles Times*.

Though Ronald Reagan's personal interest in religion is obscure, he has played avidly to the religious right by publicly endorsing the Bible and biblical beliefs, by trying to relate his policies to biblical precedents, and by employing fundamentalists in his administrations. See for example:

Anon. 1983. Quotes from President Reagan. *Christians in Education* 11(1):17.

Anon. 1984. Reagan and the Apocalypse. *New York Review of Books* 30(21+22):26.

Anon. 3 February 1984. Sermon on the stump. *New York Times*.

J. Reston. 29 August 1984. Reagan's political religion. *New York Times*.

V. S. Naipaul. 1984. Among the Republicans. *New York Review of Books* 31(16):5.

Anon. 22 February 1985. President says Bible can provide answers. *New York Times*.

R. W. Peterson. 26 March 1985. How Reagan promotes abortions. *New York Times*.

3. See, for example:

F. M. Hechinger. 3 January 1984. Censorship rises in the nation's public schools. *New York Times*. 3x306.10 B. Parker. 21 January 1984. *American delirium*. *New York Times*.

Anon. 1984. *Attacks on the Freedom to Learn: A 1983-1984 Report*. People For the American Way, 1424 16th Street, N.W. (Suite 601), Washington, D.C. 20036.

4. I quote from the May 1985 issue of *Harper's*, which carried the entire text of the letter. For a discussion of the Eagle Forum's tactic and the Hatch Amendment, see F. M. Hechinger's article cited in note 11.

5. See, for example, these recent articles in *Bible-Science Newsletter*, a monthly tabloid that offers a mixture of Bible stories, creation pseudoscience and

political notes to members of the Bible-Science Association, Inc. (Minneapolis, Minnesota):

Anon. 1984. What happens to the gospel if evolution is true? *B-S N* 22(7):6.

N. Pearcey. 1984. Interpreting Genesis: a reply to the critics. *B-S N* 22(8):7.

P. A. Bartz. 1985. Bible study: why defend creation? *B-S N* 24(3):9.

6. Pages 41, 168, and 157 of: H. M. Morris. 1982. *The Troubled Waters of Evolution*, 2nd edition. Creation-Life Publishers. San Diego, California. 217 pp. (This book also contains an excursion, beginning on page 72, in which Morris infers that Satan himself may be the originator of the concept of evolution.)

7. For a disgruntled view of evolution's role in elevating women, see: D. Ayers. 1984. Evolution and the White House. *Bible-Science Newsletter* 22(10):6.

8. See, for example: P. Kircher. 1982. *Abusing Science: The Case Against Creationism*. The MIT Press. Cambridge, Massachusetts. x + 213 pp.

9. P. A. Bartz. 1983. Lee's got to the root of the problem! *Bible-Science Newsletter* 21(12):3.

10. The Humanist Manifestoes are two statements in which the American Humanist Association (Amherst, New York) propounds a philosophy based on reason, science, personal freedom, and egalitarianism. The first was issued in 1933. It was replaced forty years later by the second, which was published in *The Humanist* 33(5). For a description of the Manifestoes and their history, see: C. Krauthammer. 1981. The humanist phantom. *The New Republic* 185(4):20.

11. See, for example:

D. Kleiman. 17 May 1981. Parents' groups purging schools of "humanist" books and classes. *New York Times*.

C. Krauthammer. 1981. The humanist phantom. *The New Republic* 185(4):20. (Krauthammer provides a fine explication of differences between the

humanism of the Humanist Manifestoes and the fictitious "humanism" that the fundamentalists use as a bogey-man.)

R. A. Baer, Jr. 1984. They are teaching religion in the public schools. *Christianity Today* 28(3):12.

D. Bolliger. 1983. *The Witch Hunt Against "Secular Humanism"*. People For the American Way. Washington, D.C. 19 pp.

F. M. Hechinger. 16 April 1985. Far right steps up effort to control classrooms. *New York Times*.

12. R. L. Simonds. 1983. *Communicating a Christian World View in the Classroom*. National Association of Christian Educators. Costa Mesa, California. (A striking idiosyncrasy of fundamentalist rhetoric, and of the naming of fundamentalist organizations, is the use of Christian to mean fundamentalist and nothing else.)

For another explicit rejection of the separation of church and state—this one alleging that the separation is a false doctrine born in a misreading of the federal Constitution—see: J. Kennedy. 1984. Fulfilling the cultural mandate. *The Rutherford Institute* 1(6):6.

13. K. L. Segraves. 1984. The offense to the Christian in the public sector. *Bible-Science Newsletter* 22(10):1. (Segraves is a man of deft imagination. Readers who have a taste for the unusual may enjoy the book in which he argues that the proprietors of flying saucers are not creatures from another planet but disgraced angels who are visiting Earth to disseminate messages from Satan: K. L. Segraves. 1975. *Sons of God Return*. Pyramid Books. New York. 191 pp.)

14. Anon. 1985. Creationist calls for civil rights hearings. *Bible-Science Newsletter* 23(1):14.

15. P. A. Bartz. 1984. Is freedom of religion for everyone? *Bible-Science Newsletter* 22(1):2.

16. T. LaHaye. 1982. *The Battle for the Family*. Fleming H. Revell Company. Old Tappan, New Jersey. 249 pp.

Afterword

See Jim and Pat Cook. Jim Cooks First.

Reprinted with permission of the New York Times, 13 March 1986.

PAT HAS A big book. Pat reads the big book. Jim reads the big book. Pat reads to Jim. Jim cooks." So begins the riveting tale of how a girl named Pat and a boy named Jim make raisin pudding and ham and tomato on toast.

Do you feel the foundations of the Republic shaking? Do you sense the faith of your fathers crumbling about your ears? Well, you should. You have just been exposed to a noxious influence called secular humanism. At least that's what Robert B. Mozert Jr. of Church Hills, Tenn., believes.

What's noxious about Jim cooking, in a primary school reader? The fact that Jim cooks *first*, before Pat, gives first-graders the idea "that there are no God-given roles for the different sexes." And that's not the only thing that people like Mr. Mozert regard as anti-God, anti-American and

anti-family. Holt Basic Reading, a series of state-approved textbooks, also mentions evolution and a few of the world's religions.

It also shows some international communications symbols, like the Olympic Games' designations for lunchroom (a cup and saucer) and first aid (a hand with one finger bandaged). These symbols, it seems, constitute an endorsement of non-verbal communication, which is a component of something fearsome called "new-age religion."

It's all so threatening that Mr. Mozert felt a duty to sue the county schools. He and COBS (Citizens Organized for Better Schools) say the Holt textbook series promotes secular humanism, and that the school system's refusal to provide an alternate violates the First Amendment rights of fundamentalist children.

This is no isolated case of know-nothing alarmism. In Mobile, Ala., more than 600 fundamentalist parents, students and teachers, joined by Gov. George Wallace, say secular humanism is a religion and should be treated like one. A "strict neutrality concept," one of their lawyers contends, "has already been equally applied to remove Judaism and Christianity from

the schools. We're asking that it be equally applied to remove humanism."

A Federal judge, Brevard Hand, agrees. "It is time to recognize," the judge says, "that the constitutional definition of religions encompasses more than Christianity, and prohibits as well the establishment of a secular religion."

If the Alabama State Board of Education capitulates to the plaintiffs today (the local board has already done so) and the parents who have risen to its defense don't take up the suit, the Federal court will have gained the authority to approve or reject textbooks.

And screening them for signs of secular humanism could mean the removal of anything—from a discussion of economics that explores the weaknesses as well as strengths of capitalism to all that stealthy E.R.A. propaganda in stories about little boys who make raisin pudding.

Since what is anti-God, anti-American and anti-family could be whatever a vocal minority says it is, tomorrow's textbooks might be pretty slim. That should suit that minority very well. Why mess up a kid's head with information when ignorance of secular humanism, and much else besides, is all the armor anybody needs?